

Hydronic solutions

CATALOG

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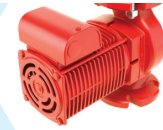
SUPERSEDES: 10.01
DATE: AUGUST 2014



COMPASS



PARTS SECTION



E.2 CIRCULATORS



CBV

CONTENTS

COMMERCIAL & RESIDENTIAL PUMPS	3	Hardware Kits	95
Design Envelope Compass Circulators	3	Flange Hardware Kits - Cross Reference	97
Astro 2 Circulators	5	Flex Flange	99
Astro 2 Hot Water Recirculation Systems	11	Flange Kits	101
Astro 2 24-hour timer	15	Seal Bearing Assemblies	105
Aquastat controls	17	Coupler Assemblies	109
Astro Express 2 Hot Water Recirculation	19	Motors	111
S&H 3-Piece Circulators	21	Seal Kits	113
1050 & 1060 3-Piece Circulators	29	Impellers	114
E.2 Circulators	33	Gaskets	118
E.2 Circulator Spool Pieces	37	Pump Bodies	119
4270 Motor Mounted Pumps	39	PARTS LOOK UP	121
4360 Pump-in-a-Box (4360, 4380, DE 4300 & DE 4380)	41	S-25	121
HYDRONIC SPECIALTIES	53	S-35	122
Air Vents (Automatic & Float)	53	H-32	123
Air Removal Trap	57	S-35	124
Diaphragm Expansion Tanks	59	S-45	125
Relief and Reducing Valves	61	S-46	127
CIRCUIT BALANCING VALVES (CBV)	63	H-41	128
Circuit Balancing Valves - Mini Sweat	63	4030 Base Mounted Pumps - Parts Cross Reference	149
Circuit Balancing Valves - Venturi	65	4280 Motor Mounted Pumps - Parts Cross Reference	161
Circuit Balancing Valves - ANSI Flanged	69	Shell & Tube Heat Exchangers - Parts Cross Reference	171
Circuit Balancing Valves - ANSI Grooved	73	4380 & 4360 VIL Pumps - Parts Cross Reference	173
Flange Adapter Kits	77	COMPETITION CIRCULATOR CROSS REFERENCE	175
PT Port & Extensions	79	Design Envelope COMPASS Circulators Cross Reference	175
Meters	81	S&H Circulators Cross Reference	176
Orifice Indicators	85	E.2 Circulators Cross Reference	177
CBV Balancing Wheel	87	Astro 2 Circulators Cross Reference	179
REPLACEMENT PARTS	89	TECHNICAL DATA	181
S&H Circulator Less Volute	89		
Companion Flanges	91		

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DESIGN ENVELOPE COMPASS CIRCULATORS

VARIABLE SPEED WET ROTOR | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

TECHNICAL DATA

Supply voltage: 1 x 115 V - 10%/+ 6%, 60 Hz

	MINIMUM	MAXIMUM
Amp	0.05	0.65
Watt	5	45

Motor protection: The pump requires no external motor protection.

Maximum working temperature: 230°F (110°C) maximum

Maximum working pressure: 150 psi (10 bar).

Maximum relative air humidity (rh): 95%.

Flow range: 0 - 20 USgpm (0 to 1.26 L/s)

Head range: 0 - 20.0 feet (0 to 6.09 m)

Enclosure class: Type 2

Insulation class: H

Certification: ETL listed for US and Canada (conforms to ULSTD.778 certified to CSA STD. C22.2 NO.108-01)
 *NSF 372 (for stainless steel models)

INLET PRESSURE

Minimum inlet pressure in relation to liquid temperature:

LIQUID TEMPERATURE	MINIMUM INLET PRESSURE
150°F (65°C)	3.0 ft (0.91 m)
167°F (75°C)	4.4 ft (1.34 m)
194°F (90°C)	9.2 ft (2.8 m)
230°F (110°C)	36.1 ft (11.0 m)

Sound pressure level: The sound pressure level of the pump is lower than 43 dB(A).

Ambient temperature: 32°F (0°C) - 104°F (40°C)

Pumped liquids: Water or water Glycol mix.

Liquid temperature: 36°F (2°C) - 230°F (110°C)**

To avoid condensation in the control box and stator, the liquid temperature must always be higher than the ambient temperature.

AMBIENT TEMPERATURE	LIQUID TEMPERATURE	
	MIN.	MAX.
32°F (0°C)	35.6°F (2°C)	230°F (110°C)
50°F (10°C)	10°C (50°F)	230°F (110°C)
68°F (20°C)	68°F (20°C)	230°F (110°C)
86°F (30°C)	86°F (30°C)	230°F (110°C)
95°F (35°C)	95°F (35°C)	194°F (90°C)
104°F (40°C)	104°F (40°C)	158°F (70°C)

MATERIALS OF CONSTRUCTION

Pump body: Cast iron (closed systems)
 Stainless steel* (open systems)

Impeller: Noryl

Shaft: Ceramic

Bearings: Ceramic

Gasket material: EPDM

HARDWARE KIT

Companion flange kit (contains two (2) flanges, hardware and gaskets)

Cast iron: 0.75", 1", 1.25", 1.5"

Bronze: 0.75", 1", 1.25", 1.5"

DESIGN ENVELOPE COMPASS CIRCULATORS

VARIABLE SPEED WET ROTOR | SUBMITTAL

DIMENSIONS AND WEIGHTS

STAINLESS STEEL*	PART NUMBER	A	B	C	D	E	F	G	CONNECTION TYPE & SIZE	WEIGHT
Compass 20-20 ss flange	180203-607	6.50 (165)	7.08 (180)	5.75 (146)	4.00 (102)	2.00 (50)	3.25 (80)	5.31 (135)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
CAST IRON	PART NUMBER	A	B	C	D	E	F	G	CONNECTION TYPE & SIZE	WEIGHT
Compass 20-20 ci flange	180203-606	6.50 (165)	7.08 (180)	5.75 (146)	4.00 (102)	2.00 (50)	3.25 (80)	5.31 (135)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)

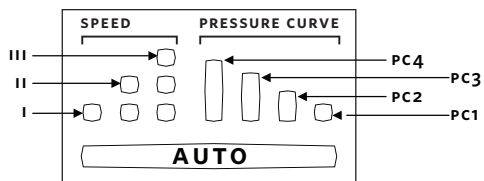
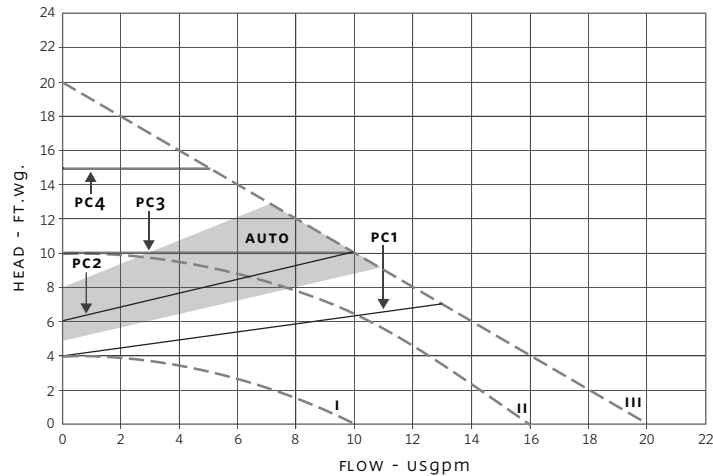
NOTE:

All dimensions are in inches (mm) and weights in lbs (kg).

*Certified <0.25 weighted average percent lead and complies with California Health and Safety Code Section 116875 (commonly known as AB 1953).

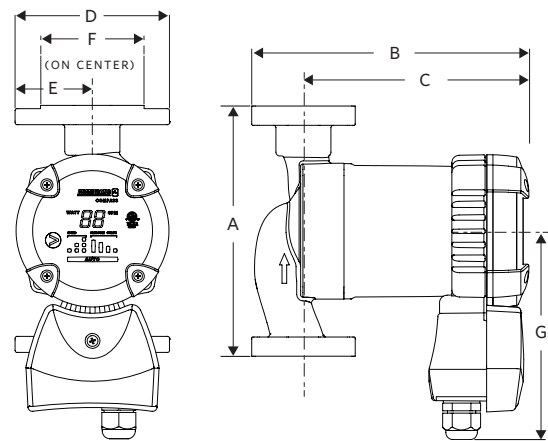
** For open systems, it is recommended that the liquid temperature be less than 150°F (65°C) to avoid precipitation of calcium.

COMPASS PERFORMANCE CURVES



Lights on the display indicate the Control mode selected.

COMPASS FLANGE



ASTRO 2 CIRCULATORS

THREE SPEED | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

TECHNICAL DATA

Flow range: 0 to 64 USgpm (0 to 4.04 L/s)

Head range: 0 to 42.0 feet (0 to 12.8 m)

Maximum fluid temperature: 185°F / 85°C (ASTRO 286 UP TO 1.35A)
 150°F / 65°C (ASTRO 286 OVER 1.35A)
 230°F / 110°C† (ALL OTHERS)

Maximum working pressure: 150 psi (1034 kPa)

Approvals:  listed NSF-372 certified
 Intertek

† For open systems, it is recommended that the fluid temperature be less than 150°F (66°C) to avoid precipitation of calcium.

MATERIALS OF CONSTRUCTION

Pump body: Cast iron (closed systems)
 Lead free bronze* (open systems)
 Stainless steel* (open systems)

Impeller: Noryl **Shaft:** Ceramic
Bearings: Ceramic **Gasket material:** EPDM

* Certified <0.25 weighted average percent lead and complies with California Health and Safety Code Section 116875 (commonly known as AB 1953).

MOTOR DATA

MODEL	ELECTRICAL INPUT	SPEED	FULL LOAD AMP DRAW (A)	NOMINAL POWER (W)
Astro 210CI/SS	115V, 60HZ Single phase	3	1.06	200
		2	1.50	
		1	1.72	
Astro 220SSU		3	0.29	33
		2	0.27	
		1	0.20	
Astro 225BS		3	0.64	75
		2	0.49	
		1	0.38	
Astro 225SSU	3	0.69	83	
	2	0.55		
	1	0.43		
Astro 230SS/CI/CI-R	3	0.81	97	
	2	0.58		
	1	0.45		
Astro 250SS/CI/CI-R	3	0.98	117	
	2	0.79		
	1	0.65		
Astro 280CI/SS	3	1.90	218	
	2	1.80		
	1	1.50		
Astro 290CI/SS	3	1.90	218	
	2	1.60		
	1	1.40		
Astro 280CI/SS 230V	230V, 60HZ Single phase	3	0.90	210
		2	0.86	
		1	0.80	
Astro 286CI/SS		1	1.60	370

ASTRO 2 CIRCULATORS

THREE SPEED | SUBMITTAL

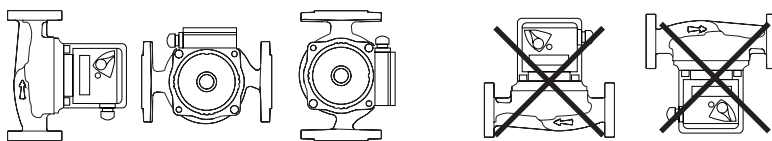
DIMENSION DATA - INCHES (MM)

LEAD FREE BRONZE*	A	B	C	D	E	F	CONNECTION TYPE & SIZE	WEIGHT
Astro 225BS ½" SWT	5.00 (127)	5.00 (127)	4.13 (105)	—	3.00 (76)	—	Sweat - ½"	6.0 (2.7)
Astro 225BS ¾" SWT	5.00 (127)	5.00 (127)	4.13 (105)	—	3.00 (76)	—	Sweat - ¾"	6.0 (2.7)
STAINLESS STEEL*	A	B	C	D	E	F	CONNECTION TYPE & SIZE	WEIGHT
Astro 220ssu**	6.00 (152)	5.00 (127)	4.00 (102)	—	3.00 (76)	—	Union - 1¼" NPSM	6.5 (2.9)
Astro 225ssu**	6.00 (152)	5.00 (127)	4.00 (102)	—	3.00 (76)	—	Union - 1¼" NPSM	6.5 (2.9)
Astro 230ss**	6.38 (162)	6.00 (150)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 250ss**	6.38 (162)	6.00 (150)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 210ss**	6.50 (165)	7.25 (184)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 280ss (230V)**	6.50 (165)	6.75 (171)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 286ss**	6.50 (165)	6.38 (162)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 290ss**	8.50 (216)	6.65 (169)	5.20 (132)	4.00 (102)	3.50 (90)	3.45 (88)	Flange - (2) ½" dia. bolt holes	13.2 (6.0)
CAST IRON	A	B	C	D	E	F	CONNECTION TYPE & SIZE	WEIGHT
Astro 230ci**	6.38 (162)	6.00 (150)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 230ci-R**	6.38 (162)	5.63 (137)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 250ci**	6.38 (162)	6.00 (150)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 250ci-R**	6.38 (162)	5.63 (137)	4.00 (102)	4.00 (102)	3.00 (76)	3.25 (80)	Flange - (2) ½" dia. bolt holes	8.0 (3.6)
Astro 210ci**	6.50 (165)	7.25 (184)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 280ci (230V)**	6.50 (165)	6.38 (162)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 286ci**	6.50 (165)	6.38 (162)	4.87 (124)	4.00 (102)	3.50 (90)	3.13 (80)	Flange - (2) ½" dia. bolt holes	10.1 (4.6)
Astro 290ci**	8.50 (216)	6.65 (169)	5.20 (132)	4.00 (102)	3.50 (90)	3.45 (88)	Flange - (2) ½" dia. bolt holes	13.2 (6.0)

NOTE: All dimensions are in inches (mm) and weights in lbs (kg).

** Removable check valve installed at pump outlet.

MOUNTING ORIENTATION



RIGHT

WRONG

PART NUMBERS

MODEL	PART NUMBER
Astro 220ssu w ½" SWT	110223-301
Astro 220ssu w ¾" SWT	110223-302
Astro 220ssu	110223-309
Astro 225BS ½" SWT	110223-303
Astro 225BS ¾" SWT	110223-304
Astro 225ssu	110223-310
Astro 230ci	110223-305
Astro 230ci-R	110223-315
Astro 230ss	110223-306

MODEL	PART NUMBER
Astro 250ci	110223-307
Astro 250ci-R	110223-317
Astro 250ss	110223-308
Astro 280ci	110223-320
Astro 280ss	110223-321
Astro 280ci (230V)	110223-322
Astro 280ss (230V)	110223-323
Astro 286ci (230V)	110223-324
Astro 286ss (230V)	110223-325

MODEL	PART NUMBER
Astro 210ci	110223-326
Astro 210ss	110223-327
Astro 290ci	110223-328
Astro 290ss	110223-329

ASTRO 2 CIRCULATORS

THREE SPEED | SUBMITTAL

ACCESSORIES

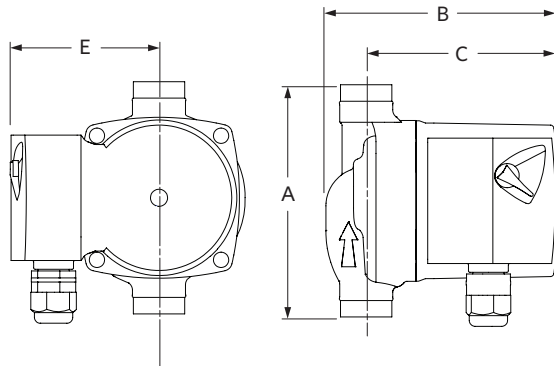
LEAD FREE* UNION FITTING SETS (contains two (2) half unions and gaskets)

MODEL	PART NUMBER	CONNECTION
Astro 220SSU/225SSU	810120-320	1.25" NPSM × 0.5" sweat lead free
	810120-322	1.25" NPSM × 0.75" sweat lead free
	810120-324	1.25" NPSM × 0.75" FNPT lead free

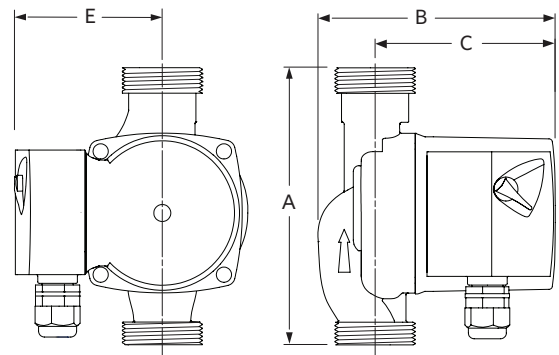
MODEL	FLANGE KITS		
	SIZE	ITEM NUMBER	
		LEAD FREE BRONZE*	CAST IRON
Astro 210/230/250 /280/286 Compass	0.75"	816013-841	816013-111
	1"	816012-841	816012-111
	1.25"	816011-841	816011-111
	1.5"	816009-841	816009-111
Astro 290	1"	806073-841	806073-111
	1.25"	804300-841	804300-111
	1.5"	804301-841	804301-111

MODEL	CIF			FLEX FLANGES		
	MODEL	SIZE	ITEM NUMBER	MODEL	SIZE	ITEM NUMBER
All Astro flange models	CIF-050T	½"	110124-100	FF-050T	½"	110124-200
	CIF-075T	¾"	110124-000	FF-075T	¾"	110124-201
	CIF-100T	1"	110124-001	FF-100T	1"	110124-202
	CIF-125T	1¼"	110124-002	FF-125T	1¼"	110124-203
	CIF-150T	1½"	110124-003	FF-150T	1½"	110124-204
	CIF-050S	½"	110124-150	FF-050S	½"	110124-250
	CIF-075S	¾"	110124-050	FF-075S	¾"	110124-251
	CIF-100S	1"	110124-051	FF-100S	1"	110124-252
	CIF-125S	1¼"	110124-052	FF-125S	1¼"	110124-253
CIF-150S	1½"	110124-053	FF-150S	1½"	110124-254	

ASTRO 225BS



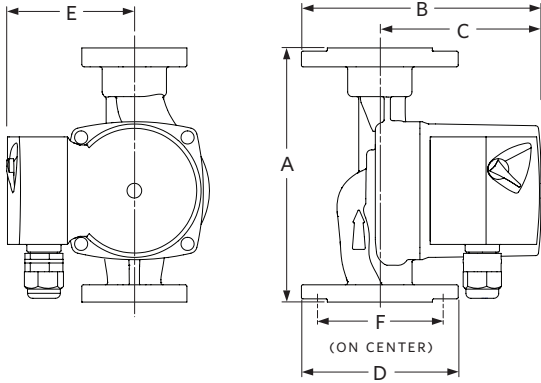
ASTRO 220SSU, 225SSU



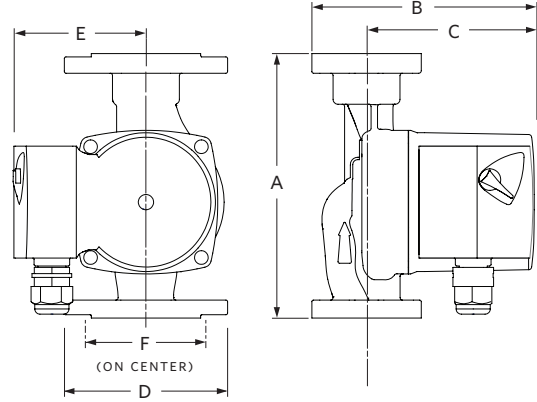
ASTRO 2 CIRCULATORS

THREE SPEED | SUBMITTAL

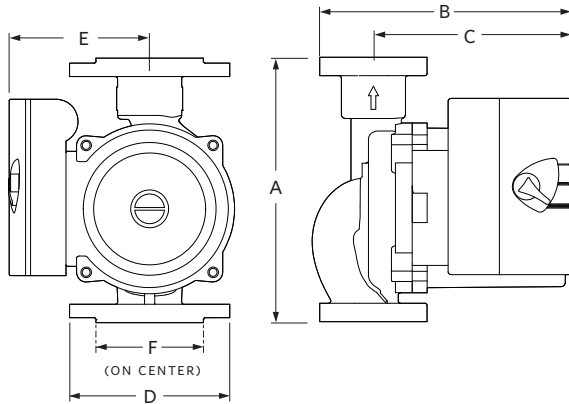
ASTRO 230SS/CI, 250SS/CI



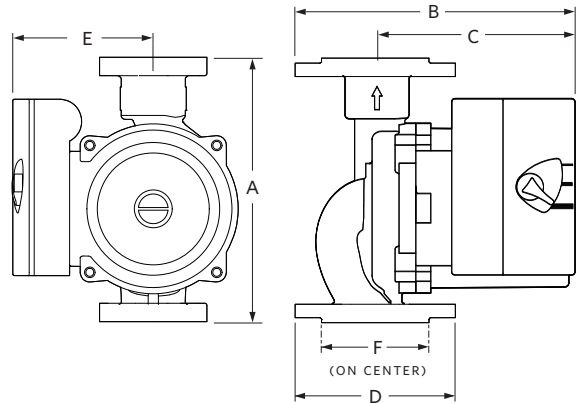
ASTRO 230CI-R, 250CI-R



ASTRO 280CI, 290CI/SS, 286CI/SS

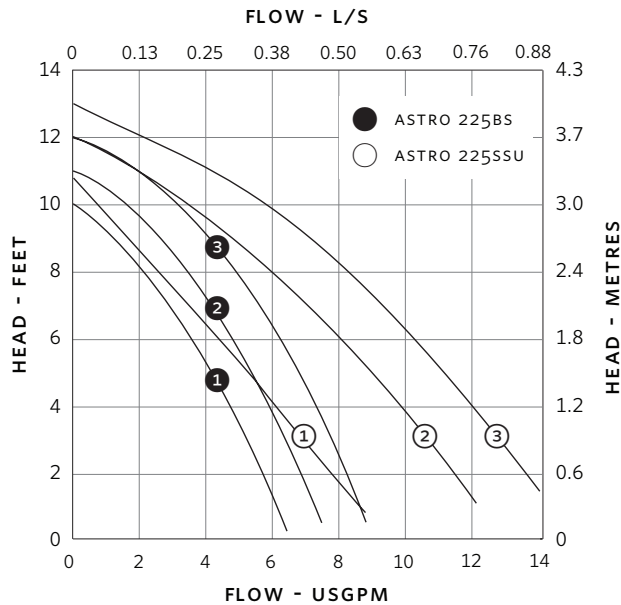


ASTRO 280SS, 210CI/SS

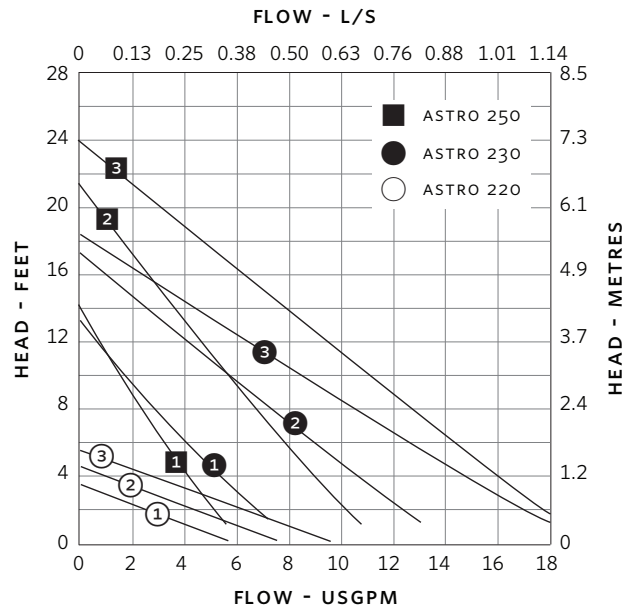


PERFORMANCE CURVE

ASTRO 225BS, 225SSU



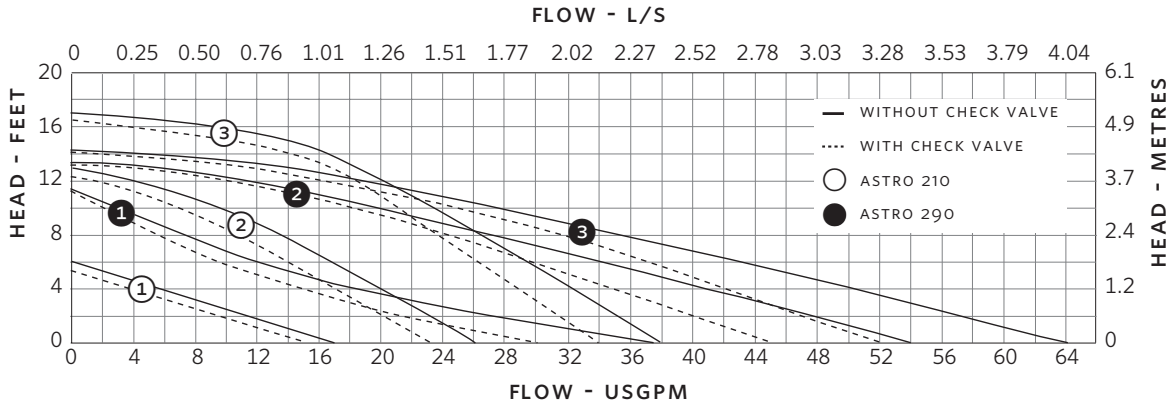
ASTRO 250, 230, 220



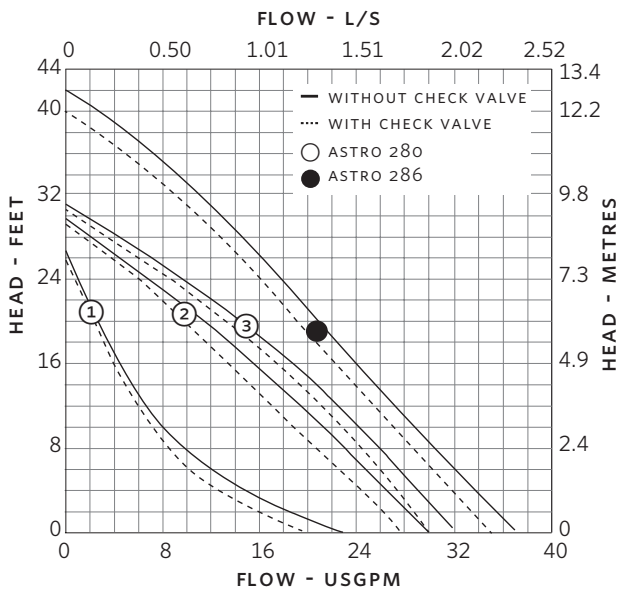
ASTRO 2 CIRCULATORS

THREE SPEED | SUBMITTAL

ASTRO 210, 290



ASTRO 280, 286



ASTRO 2 | HOT WATER RE-CIRCULATION SYSTEMS SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

PUMP DESIGN DATA

Pump model: _____ Flange size: _____
 No. of pumps: _____ Note: _____
 Capacity: _____ USgpm (L/s) Temperature: _____ °F (°C)
 Head: _____ ft (m) Liquid: _____
 Companion flanges: _____ Included: _____

TECHNICAL DATA

Power connection: 6.0 ft. (1.8 m) power cord, molded duplex plug with ground

Environment: Indoor use only

Flow range: 0 to 64 USgpm (0 to 4.04 L/s)

Head range: 0 to 42.0 feet (0 to 12.8 m)

Max. working pressure: 150 PSI (1034 kPa)

Max. water temperature: 230°F (110°C)[†]

Ambient temperature: 39°F (4°C) to 104°F (40°C)

Low temperature switchpoint¹: 85°F (29°C) ± 10%

High temperature switchpoint¹: 105°F (40°C) ± 10%

Clock/timer: 12 hour analog clock with AM/PM indication

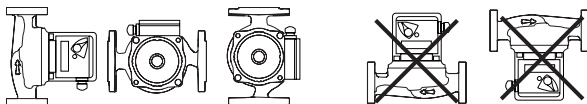
Timer settings: Individual mechanical toggles for each 15 minute interval over 24 hours

Manual override: Three position slide switch; ON/AUTO/OFF

Approvals:  US listed NSF-372 certified
 Intertek

¹ High/low temperature switchpoints are as measured on pipe surface with the Aquastat (TA models only).
[†] For open systems, it is recommended that the fluid temperature be less than 150°F (66°C) to avoid precipitation of calcium.

MOUNTING ORIENTATION



RIGHT

WRONG

APPLICATION

Armstrong Astro 2 hot water re-circulation systems automatically circulate water through domestic hot water distribution pipes. This helps to ensure that everyone in the household has 'instant' hot water at the tap when they need it, while also helping to conserve water and save water heating energy costs. All systems are assembled, wired, tested and then shipped, ready for installation.

MATERIALS OF CONSTRUCTION

Pump body: Lead free bronze* (BS models)
 Stainless steel* (ss models)

Impeller: Noryl **Shaft:** Ceramic
Bearings: Ceramic **Gasket material:** EPDM

* Certified <0.25 weighted average percent lead and complies with California Health and Safety Code Section 116875 (commonly known as AB 1953).

MOTOR DATA

MODEL	ELECTRICAL INPUT	SPEED	FULL LOAD AMP DRAW (A)	NOMINAL POWER (W)
ASTRO 220SSU	115V, 60HZ Single phase	3	0.29	33
		2	0.27	
		1	0.20	
ASTRO 225BS		3	0.64	75
		2	0.49	
		1	0.38	
ASTRO 225SSU		3	0.69	83
		2	0.55	
		1	0.43	
ASTRO 230SS		3	0.81	97
	2	0.58		
	1	0.45		
ASTRO 250SS	3	0.98	117	
	2	0.79		
	1	0.65		

ASTRO 2 | HOT WATER RE-CIRCULATION SYSTEMS

SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	A	B	C	D	E	F
ASTRO 225BS	5.0 (127)	6.5 (165)	5.6 (142)	7.1 (180)	4.3 (110)	1.8 (46)
ASTRO 220/225SSU	5.0 (127)	5.3 (134)	4.4 (112)	6.3 (160)	3.4 (86)	1.8 (46)
ASTRO 230/250SS	6.4 (162)	8.7 (221)	6.8 (173)	7.0 (178)	3.7 (93)	1.8 (46)

NOTE: All dimensions are in inches (mm)

MODEL	CONNECTION	SIZE	CORD	TIMER	AQUASTAT	ELECTRICAL DATA @ 115 Vac, 60 Hz	WEIGHT	PART NUMBER
ASTRO 220SSU050S-TA*	Sweat	½"	✓	✓	✓	0.29 A, 33W	7.50 (3.40)	110223-140
ASTRO 220SSU075S-TA*	Sweat	¾"	✓	✓	✓	0.29 A, 33W	7.50 (3.40)	110223-141
ASTRO 225BS050S-TA	Sweat	½"	✓	✓	✓	0.64 A, 75W	7.00 (3.18)	110223-142
ASTRO 225BS075S-TA	Sweat	¾"	✓	✓	✓	0.64 A, 75W	7.00 (3.18)	110223-143
ASTRO 220SSU-TA	NPSM union	1¼"	✓	✓	✓	0.29 A, 33W	7.50 (3.40)	110223-144
ASTRO 225SSU-TA	NPSM union	1¼"	✓	✓	✓	0.69 A, 83W	7.50 (3.40)	110223-145
ASTRO 230SS-TA	2 bolt flange	2 bolt flange	✓	✓	✓	0.81 A, 97W	10.00 (4.54)	110223-148
ASTRO 250SS-TA	2 bolt flange	2 bolt flange	✓	✓	✓	0.98 A, 117W	10.00 (4.54)	110223-149
ASTRO 220SSU050S-T*	Sweat	½"	✓	✓	—	0.29 A, 33W	7.50 (3.40)	110223-240
ASTRO 220SSU075S-T*	Sweat	¾"	✓	✓	—	0.29 A, 33W	7.50 (3.40)	110223-241
ASTRO 225BS050S-T	Sweat	½"	✓	✓	—	0.64 A, 75W	7.00 (3.18)	110223-242
ASTRO 225BS075S-T	Sweat	¾"	✓	✓	—	0.64 A, 75W	7.00 (3.18)	110223-243
ASTRO 220SSU-T	NPSM union	1¼"	✓	✓	—	0.29 A, 33W	7.50 (3.40)	110223-244
ASTRO 225SSU-T	NPSM union	1¼"	✓	✓	—	0.69 A, 83W	7.50 (3.40)	110223-245
ASTRO 230SS-T	2 bolt flange	2 bolt flange	✓	✓	—	0.81 A, 97W	10.00 (4.54)	110223-248
ASTRO 250SS-T	2 bolt flange	2 bolt flange	✓	✓	—	0.98 A, 117W	10.00 (4.54)	110223-249
ASTRO 220SSU050S-LC*	Sweat	½"	✓	—	—	0.29 A, 33W	7.00 (3.18)	110223-340
ASTRO 220SSU075S-LC*	Sweat	¾"	✓	—	—	0.29 A, 33W	7.00 (3.18)	110223-341
ASTRO 225BS050S-LC	Sweat	½"	✓	—	—	0.64 A, 75W	6.50 (2.95)	110223-342
ASTRO 225BS075S-LC	Sweat	¾"	✓	—	—	0.64 A, 75W	6.50 (2.95)	110223-343
ASTRO 220SSU-LC	NPSM union	1¼"	✓	—	—	0.29 A, 33W	7.00 (3.18)	110223-344
ASTRO 225SSU-LC	NPSM union	1¼"	✓	—	—	0.69 A, 83W	7.00 (3.18)	110223-345
ASTRO 230SS-LC	2 bolt flange	2 bolt flange	✓	—	—	0.81 A, 97W	9.00 (4.08)	110223-348
ASTRO 250SS-LC	2 bolt flange	2 bolt flange	✓	—	—	0.98 A, 117W	9.00 (4.08)	110223-349

NOTE: All weights are in lbs. (kg) *Union model with sweat hardware kit.

ACCESSORIES

24 HOUR TIMER

MODEL	PART NUMBER
24 HOUR TIMER	810123-130

See page 49 for the details on 24-Hour Timer

AQUASTAT

MODEL	PART NUMBER
½"	110123-120
¾"	110123-121

See Page 85 for the details on Aquastat models.

ASTRO 2 | HOT WATER RE-CIRCULATION SYSTEMS SUBMITTAL

LEAD FREE* UNION FITTING SETS (contains two (2) half unions and gaskets)

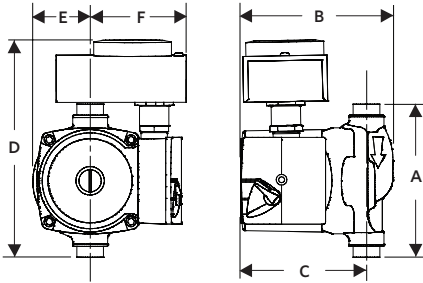
MODEL	PART NUMBER	CONNECTION
Astro 220SSU/225SSU	810120-320	1.25" NPSM × 0.5" sweat lead free
	810120-322	1.25" NPSM × 0.75" sweat lead free
	810120-324	1.25" NPSM × 0.75" FNPT lead free

MODEL	FLANGE KITS		
	SIZE	ITEM NUMBER	
		LEAD FREE BRONZE*	CAST IRON
Astro 210/230/250 /280/286 Compass	0.75"	816013-841	816013-111
	1"	816012-841	816012-111
	1.25"	816011-841	816011-111
	1.5"	816009-841	816009-111
Astro 290	1"	806073-841	806073-111
	1.25"	804300-841	804300-111
	1.5"	804301-841	804301-111

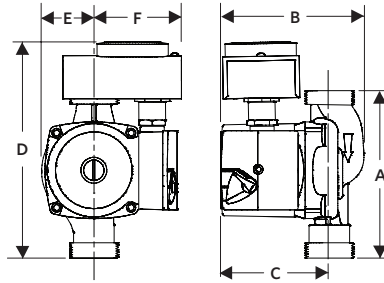
MODEL	CIF			FLEX FLANGES		
	MODEL	SIZE	ITEM NUMBER	MODEL	SIZE	ITEM NUMBER
All Astro flange models	CIF-050T	½"	110124-100	FF-050T	½"	110124-200
	CIF-075T	¾"	110124-000	FF-075T	¾"	110124-201
	CIF-100T	1"	110124-001	FF-100T	1"	110124-202
	CIF-125T	1¼"	110124-002	FF-125T	1¼"	110124-203
	CIF-150T	1½"	110124-003	FF-150T	1½"	110124-204
	CIF-050S	½"	110124-150	FF-050S	½"	110124-250
	CIF-075S	¾"	110124-050	FF-075S	¾"	110124-251
	CIF-100S	1"	110124-051	FF-100S	1"	110124-252
	CIF-125S	1¼"	110124-052	FF-125S	1¼"	110124-253
	CIF-150S	1½"	110124-053	FF-150S	1½"	110124-254

ASTRO 2 | HOT WATER RE-CIRCULATION SYSTEMS SUBMITTAL

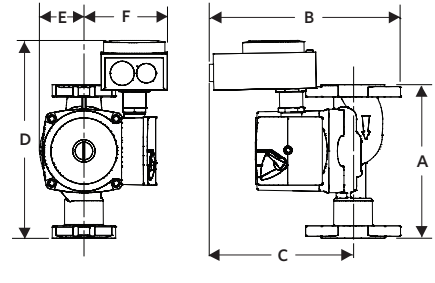
ASTRO 225BS



ASTRO 220/225SSU

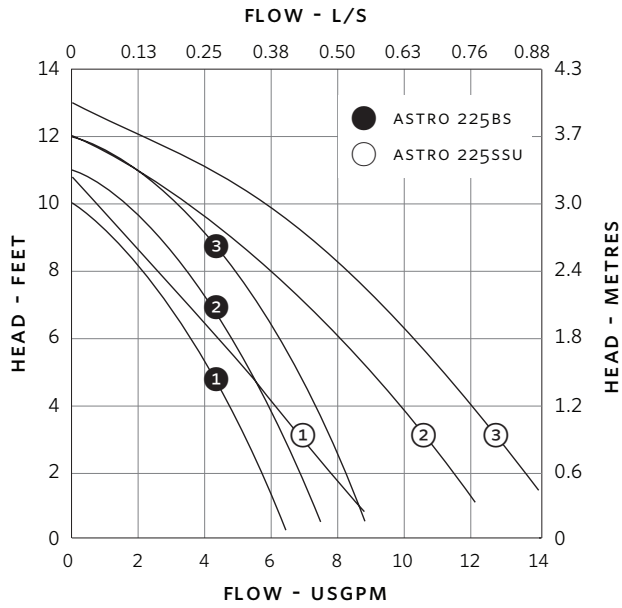


ASTRO 230/250SS

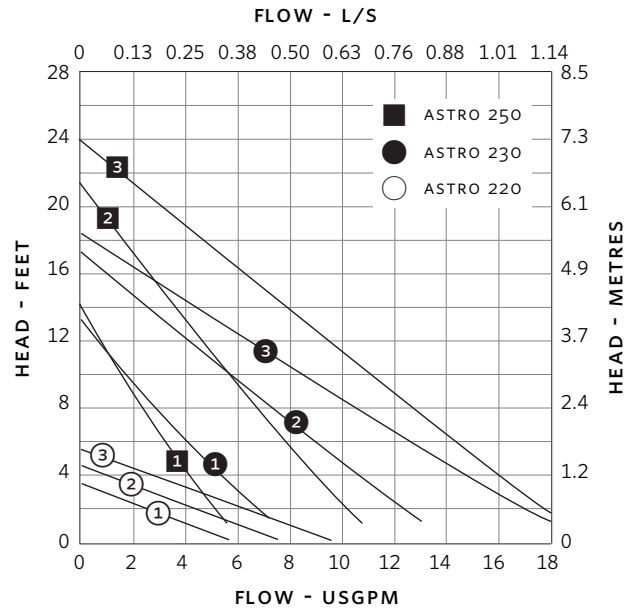


PERFORMANCE CURVE

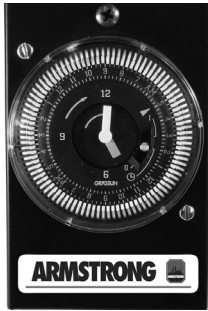
ASTRO 225BS, 225SSU



ASTRO 250, 230, 220



ASTRO 2 | 24 HOUR TIMER | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

QUANTITY	TAG NO.	MODEL NO.	COMMENTS

TECHNICAL DATA

Description: 24 hour timer
Application: Time actuated ON/OFF pump control
Shortest switching interval: ¼ hour (15 minutes)
Manual switch modes: Timer, ON override, OFF override
Ambient temperature range: -40°F to 180°F (-40°C to 82°C)
Power consumption: 120 V, 0.5 W
Supply voltage: 110-120 VAC, 60 Hz
Terminals: ¼" spade terminals
Switch rating: Type: Spot
 Resistive: 21A
 Tungsten: 1350 W
 Inductive: 1 hp @ 120 VAC; 2 hp @ 240 VAC

PART NUMBERS

24 hour timer: 810123-130

APPLICATION

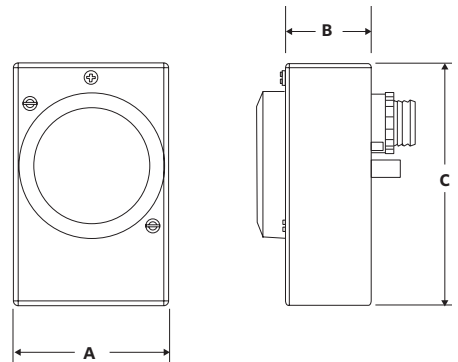
Armstrong 24 hour timers provide ON/OFF pump control according to preset operating times in order to increase occupant comfort and improve the overall efficiency of domestic hot water re-circulation systems. The 24 hour timers are designed only for use with specified Armstrong Astro series wet rotor circulators installed in indoor hot water re-circulation applications.

Typical timer applications will cycle the pump at preset times, allowing the user to select operation of the circulating pump during high peak usage periods in order to decrease the delivery time to outlet fixtures and reduce wasted water.

The timer control is programmable to ¼ hour intervals within a 24 hour time frame utilizing a user-friendly analog clock timer with hour and minute hands, two directional arrows, and AM/PM time setting.

DIMENSION DATA - INCHES (MM)

MODEL	DIMENSIONS INCHES (mm)			WEIGHT lbs (oz.)
	A	B	C	
24 hour timer	2.74 (70)	1.50 (38)	4.23 (107)	0.19 (3.0)



AQUASTAT CONTROLS

1/2" & 3/4" | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

TECHNICAL DATA

Description: Aquastat (thermostatic) switch

Application: Clip-on thermostatic control for Astro circulators

Type: Bi-metallic disc, snap-acting

Enclosure: Environmentally sealed

Mounting: Clip-on mount for 1/2" (12.7 mm) I.D. copper tube [5/8" (15.8 mm) O.D.]
 Clip on mount for 3/4" (19.0 mm) I.D. copper tube [7/8" (22.2 mm) O.D.]

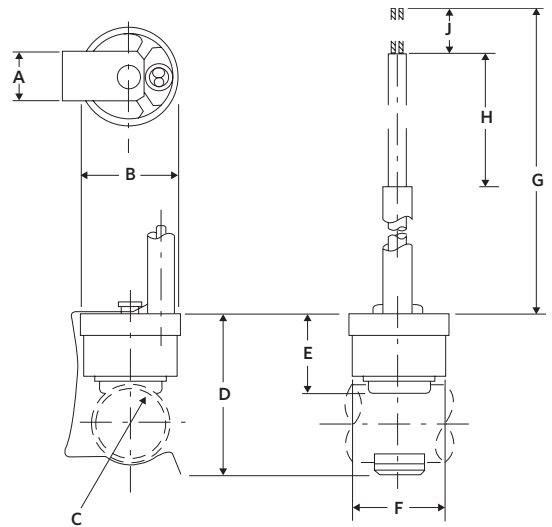
Contact rating: 10 A @ 120 V, 60 Hz resistive; 5 A @ 240 V, 60 Hz resistive

Temperature Rating* : 105±5°F (40±2°C) pump switches OFF
 85±6°F (29±3°C) pump switches ON

Leads: • 2 Leads, AWG 18, 14" (356 mm)

- 12" (305 mm), black insulation, silicon or epoxy overmold
- 1/2" (12.7 mm) strip length

* Temperatures indicated are at pipe surface



DIMENSION DATA - INCHES (MM)

MODEL	DIMENSIONS INCHES (mm)								
	A	B	C	D	E	F	G	H	J
1/2" Aquastat	0.56 (14.2)	1.12 (28.4)	0.625 (15.8) nominal pipe o.d.	1.7 (43.2)	0.96 (24.4)	1.04 (26.4)	14.0 (355.6)	2.0 (50.8)	0.5 (12.7)
3/4" Aquastat	0.56 (14.2)	1.12 (28.4)	0.875 (22.2) nominal pipe o.d.	1.8 (45.7)	0.96 (24.4)	1.04 (26.4)	14.0 (355.6)	2.0 (50.8)	0.5 (12.7)

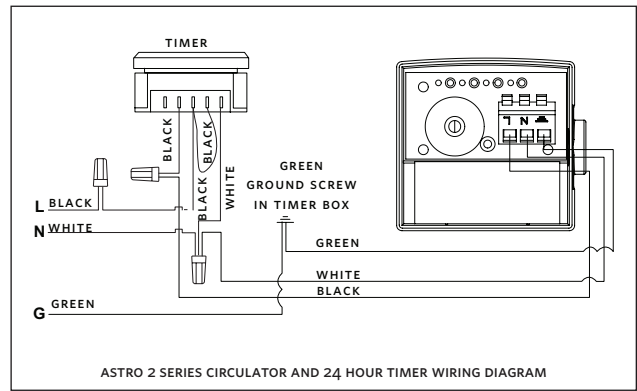
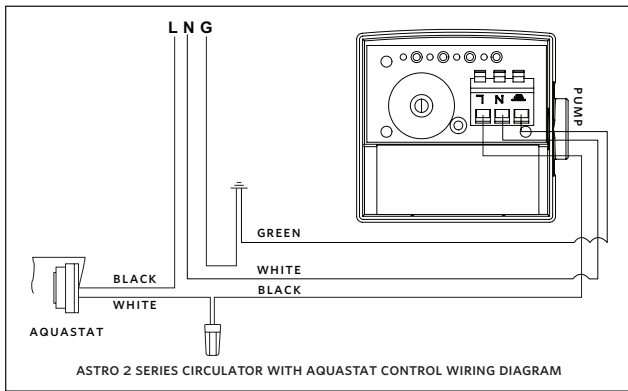
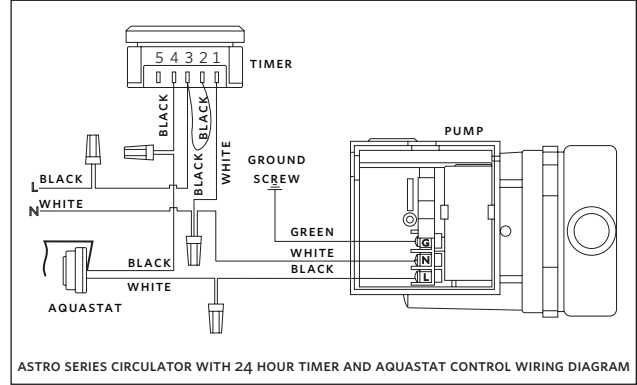
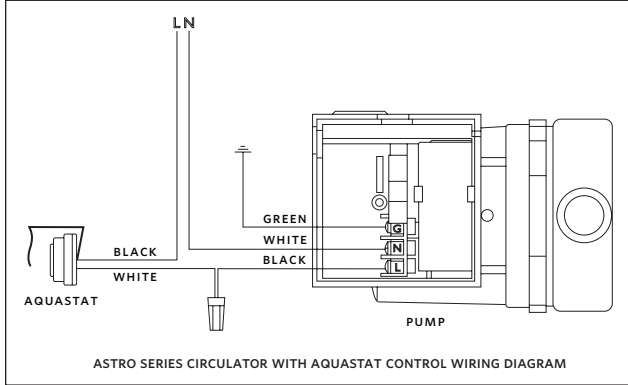
PART NUMBERS

MODEL	PART NUMBER
1/2" Aquastat	110123-120
3/4" Aquastat	110123-121

AQUASTAT CONTROLS

1/2" & 3/4" | SUBMITTAL

WIRING DIAGRAM



ASTRO EXPRESS 2

HOT WATER RECIRCULATION | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

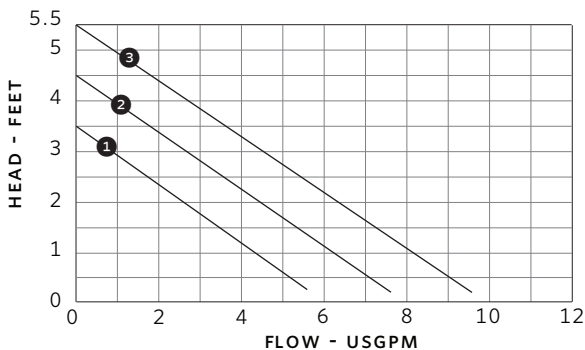
QUANTITY	DESCRIPTION
	*Astro Express 2 system (Wet rotor circulator with timer, line cord, union hardware, and one Astro Express LF valve)
	*Astro Express LF valve (only) for lengthy branches to additional faucets off main distribution pipe

MATERIALS OF CONSTRUCTION

ASTRO EXPRESS 2 CIRCULATOR

- Pump casing:** Astro 220SSU with 1 1/4" NPSM union threads
- Power connection:** 6.0 ft (1.8 m) power cord, molded duplex plug with ground
- Impeller:** PA66
- Shaft:** Ceramic
- Bearings/seal:** Ceramic/EPDM
- Union tailpieces:** Brass, 3/4" FPT (two) and 3/4" MPT (one)
- Union gaskets:** EPDM (two)

PERFORMANCE CURVE



TECHNICAL DATA

ASTRO EXPRESS 2 CIRCULATOR

- Power requirements:** 115 VAC, 60 Hz, 33 W, 0.29 A max.
- Max. head (Astro 220SSU):** 5.3 ft (1.6 m)
- Max. flow (Astro 220SSU):** 10.0 gpm (0.63 L/s)
- Ambient temperature:** 39°F (4°C) to 104°F (40°C)
- Clock timer:** 12 hour analog clock with AM/PM indication
- Timer settings:** Individual toggles for each 15 minute interval over 24 hours
- Manual override:** 3 position slide switch, ON/OFF/AUTO

ASTRO EXPRESS LF VALVE

- Housing:** Forged eco brass* with noryl cap
- Internal components:** Stainless steel and plastic with EPDM O-rings
- Connections:** Threaded, 1/2" hot & cold inlets, 3/8" hot & cold outlets
- Flowrate adjustment:** 0 - 100%, multi-turn slotted screw
- Mounting:** Plastic wall anchor with screw

Environment: Indoor use only

Max. working pressure: 100 PSI (689 kPa)

Max. water temperature: 140°F (60°C)

Approvals: listed NSF-372 certified

*Complies with Section 116875 of the California Health and Safety Code and Vermont Act 193. (Lead content of all wetted surface is 0.25% or less.)

MOUNTING ORIENTATION

Connect the hot and cold water supply to the Astro Express LF valve 1/2" threaded inlets. (Stainless steel flex hose recommended.)

Connect the hot and cold Astro Express LF valve 3/8" threaded outlets to the faucet. (Stainless steel flex hose recommended.)

Secure the valve to the wall under the sink, using the plastic wall anchor and screw.

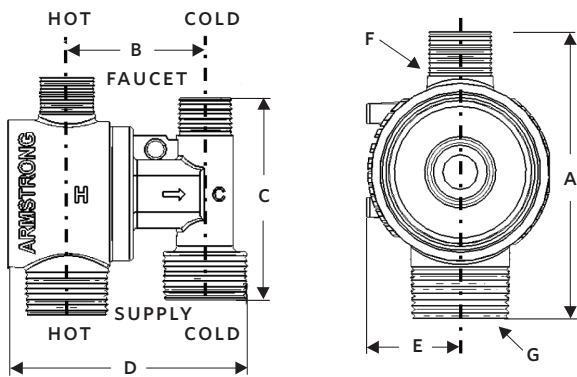
ASTRO EXPRESS 2

HOT WATER RECIRCULATION | SUBMITTAL

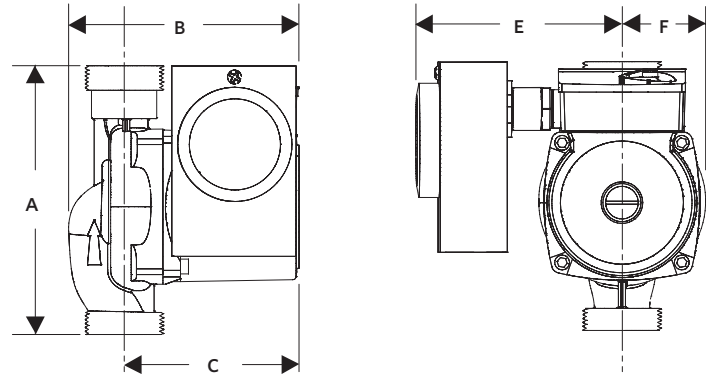
DIMENSION DATA - INCHES (MM)

PRODUCT	DIMENSIONS INCHES (mm)							WEIGHT lbs (kg)
	A	B	C	D	E	F	G	
Astro Express 2 circulator	6.00 (152)	5.00 (127)	4.00 (102)	—	5.00 (127)	1.80 (46)	—	10.00 (4.45)
Astro Express LF valve	2.50 (63)	1.50 (38)	2.10 (53)	2.60 (66)	0.80 (20)	3/8" IPS	1/2" IPS	0.50 (0.23)

ASTRO EXPRESS LF VALVE



ASTRO EXPRESS 2 CIRCULATOR



PART NUMBERS

MODEL	PART NUMBER
Astro Express 2 circulator	110223-401
Astro Express LF valve	561100LF-001

REPLACEMENTS PARTS

PRODUCT	PART NO.	
Astro Express LF valve	561100LF-001	See page 84 for the details on Astro Express LF valve
Timer	810123-130	See page 49 for the details on 24 hour timer
Union kits (Lead free brass*)	810120-320	See page 181 for the details on Union Fitting Sets
	810120-322	
	810120-324	

S&H 3-PIECE CIRCULATORS

S MODELS | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

PART NAME	BRONZE FITTED	LEAD FREE BRONZE*
Pump Body	Cast iron	Lead free Bronze

Impeller: Non-ferrous

Bearings: Sleeve - Oil lubricated**
 Maintenance free - Permanently lubricated***

Seal: Mechanical

Stationary seal face: Sintered silicon carbide

Coupler: s25-s46: Flexible, 4 - Spring;
 s55-s69: Flexible spacer type

Motor: Single phase - 1800 RPM - Resilient mounted
 Three phase - 1800 RPM - Resilient mounted

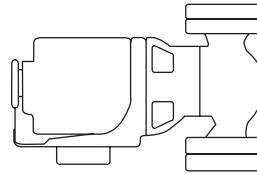
* Contains less than 0.25% lead, weighted average.

** Alloy shaft with copper sleeve.

*** Stainless steel shaft.

MOUNTING ORIENTATION

The pump should be installed in a position to permit proper lubrication of bearings and servicing. Motor and bearing bracket are to be kept free of insulation. Pump and motor unit are designed to be supported by the in line piping only. Do not support in any other manner. A height of approximately 4 feet above floor is recommended.

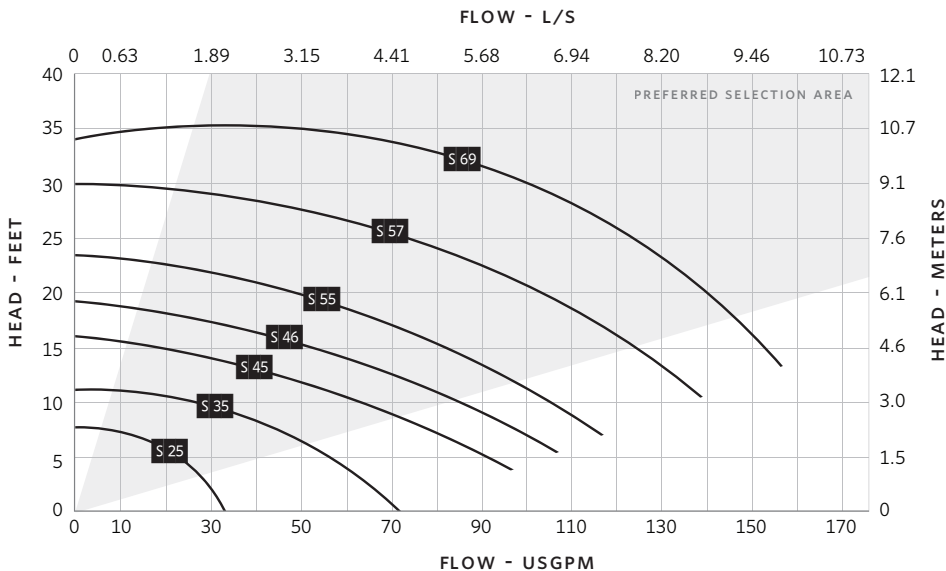


HORIZONTAL MOUNTING

MAXIMUM PUMP OPERATING CONDITIONS

125 psig at 225°F (863 kPa at 107°C)

PERFORMANCE CURVE



Based on 1800 RPM, 60 Hz motors. For 50 Hz motors write for special capacity charts.

S&H 3-PIECE CIRCULATORS

S MODELS | SUBMITTAL

DIMENSION DATA - INCHES (MM)

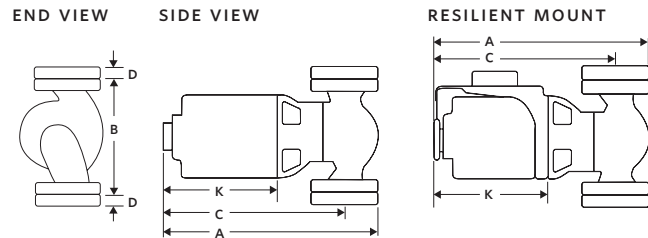
MODEL	FLANGE SIZE (N.P.T)	MOTOR**		DIMENSIONS INCHES (mm)				WEIGHT lbs (kg)
		HP	PHASE AND VOLT	A	B	C	D	
S25	¾	½ ₁₂	1 phase 115 v	13.75 (349)	6.50 (165)	11.50 (292)	0.75 (19)	19 (8.6)
	1	½ ₁₂	1 phase 115 v	13.75 (349)	6.50 (165)	11.50 (292)	0.75 (19)	19 (8.6)
	1¼	½ ₁₂	1 phase 115 v	13.75 (349)	6.50 (165)	11.50 (292)	0.88 (22)	19 (8.6)
	1½	½ ₁₂	1 phase 115 v	13.75 (349)	6.50 (165)	11.50 (292)	0.88 (22)	19 (8.6)
S35	2	¾	1 phase 115 v	15.00 (581)	8.50 (216)	12.50 (318)	0.88 (22)	38 (17.2)
S45	2½	¾	1 phase 115 v	15.75 (400)	10.00 (254)	12.50 (318)	1.00 (25)	45 (20.4)
	3	¾	1 phase 115 v	15.75 (400)	10.00 (254)	12.50 (318)	1.00 (25)	45 (20.4)
S46	3	¾	1 phase 115 v	15.75 (400)	10.00 (254)	12.50 (318)	1.00 (25)	51 (23.1)
S55	3	¾	1 phase 115/230 v	19.50 (495)	12.00 (305)	16.00 (406)	1.00 (25)	82 (37.2)
	3	¾	3 phase 208-230/460 v	19.50 (495)	12.00 (305)	16.00 (406)	1.00 (25)	74 (33.6)
	3	¾	3 phase 575 v	19.50 (495)	12.00 (305)	16.00 (406)	1.00 (25)	74 (33.6)
S57	3	¾	1 phase 115/230 v	20.00 (508)	12.00 (305)	16.50 (419)	1.00 (25)	82 (37.2)
	3	¾	3 phase 208-230/460 v	20.00 (508)	12.00 (305)	16.50 (419)	1.00 (25)	76 (34.5)
	3	¾	3 phase 575 v	20.00 (508)	12.00 (305)	16.50 (419)	1.00 (25)	76 (34.5)
S69	3	1	1 phase 115/230 v	25.00 (635)	14.25 (362)	20.25 (514)	1.00 (25)	130 (59.0)
	3	1	3 phase 208-230/460 v	25.00 (635)	14.25 (362)	20.25 (514)	1.00 (25)	125 (56.7)
	3	1	3 phase 575 v	25.00 (635)	14.25 (362)	20.25 (514)	1.00 (25)	125 (56.7)

Dimensions shown are for reference only. For exact dimensional data, contact factory.

Companion flanges are not furnished as standard on S-25, S-45 and H-32.

Conduit box not supplied on ½ hp or greater.

** All single phase motors are equipped with a built-in thermal overload protection. Three phase motors require external overload protection.



PART NUMBERS

MODEL	STANDARD DESIGN		MAINTENANCE FREE DESIGN	
	BRONZE FITTED	LEAD FREE* BRONZE	BRONZE FITTED	LEAD FREE* BRONZE
	ITEM NO.	ITEM NO.	ITEM NO.	ITEM NO.
S25	174031-013	174031LF-043	174031MF-013	174031MF-043
S35	174033-013	174033LF-043	174033MF-013	174033MF-043
S45	174036-113	174036LF-143	174036MF-113	174036MF-143
S46	174037-113	174037LF-143	174037MF-113	174037MF-143
S55 (1 Phase)	106284-132	106284LF-133	106284MF-132	106284MF-133
S55 (3 Phase)	106284-136	106284LF-137	106284MF-136	106284MF-137
S55 (3 pH 575 V)	106284-010	106284LF-011	106284MF-010	106284MF-011
S57 (1 Phase)	106285-132	106285LF-133	106285MF-132	106285MF-133
S57 (3 Phase)	106285-136	106285LF-137	106285MF-136	106285MF-137
S57 (3 pH 575 V)	106285-010	106285LF-011	106285MF-010	106285MF-011
S69 (1 Phase)	116531-132	116532LF-133	N/A	N/A
S69 (3 Phase)	116535-136	116536LF-137	N/A	N/A
S69 (3 pH 575 V)	116539-000	116540LF-000	N/A	N/A

NOTE:

STANDARD DESIGN circulators are with Sleeve Bearing SBA and MAINTENANCE FREE DESIGN circulators are with ball bearing SBA.

S&H 3-PIECE CIRCULATORS

S MODELS | SUBMITTAL

COMPANION SINGLE FLANGE PART NUMBERS

SIZE	CAST IRON	LF BRONZE
¾	116013-011	116013-841
1	116012-011	116012-841
1¼	116011-011	116011-841
1½	116009-011	116009-841
2	105210-011/106074-011	105210-841/106074-841
2½	105189-011	105189-841
3	105188-011/133615-010	105188-841/106466-841

S&H 3-PIECE CIRCULATORS

H MODELS | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

PART NAME	H-32 TO H-54 BRONZE FITTED	H-63 TO H-68 BRONZE FITTED	H-32 TO H-54 LEAD FREE BRONZE*	H-63 TO H-68 LEAD FREE BRONZE*
Pump body	Cast iron	Cast iron	Lead free bronze	Lead free bronze
Coupler	H-32 & H-41 flexible, 4-spring H-51 to H-54 flexible, spacer type	Flexible, spacer type	H-32 & H-41 flexible, 4-spring H-51 to H-54 flexible, spacer type	Flexible, spacer type

Impeller: Non-ferrous

Bearings: Sleeve - Oil lubricated**
 Maintenance free - Permanently lubricated***

Seal: Mechanical

Stationary seal face: Sintered silicon carbide

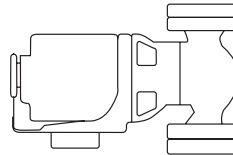
* Contains less than 0.25% lead, weighted average.

** Alloy shaft with copper sleeve.

*** Stainless steel shaft.

MOUNTING ORIENTATION

The pump should be installed in a position to permit proper lubrication of bearings and servicing. Motor and bearing bracket are to be kept free of insulation. Pump and motor unit are designed to be supported by the in line piping only. Do not support in any other manner. A height of approximately 4 feet above floor is recommended.

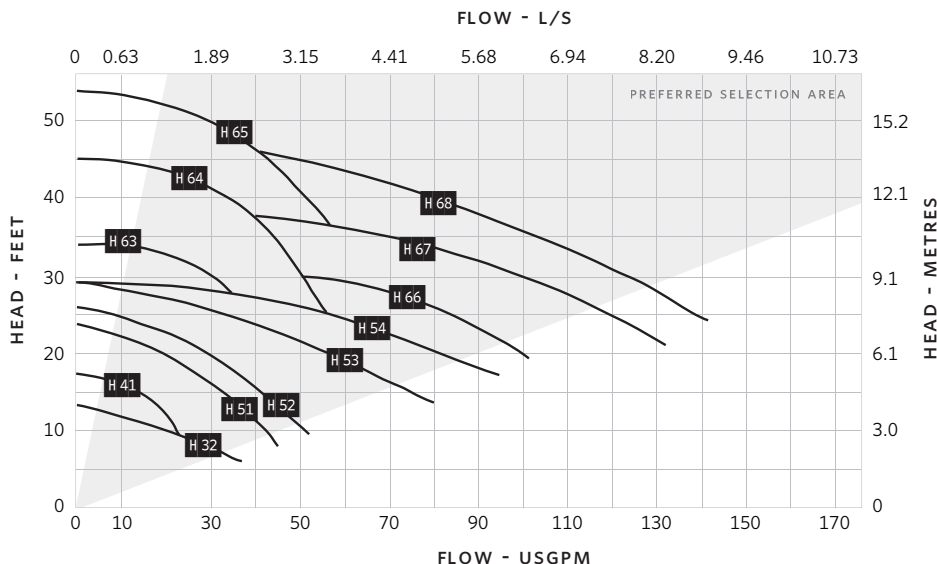


HORIZONTAL MOUNTING

MAXIMUM PUMP OPERATING CONDITIONS

125 psig at 225°F (863 kPa at 107°C)

PERFORMANCE CURVE



Based on 1800 RPM, 60 Hz motors. For 50 Hz motors write for special capacity charts.

S&H 3-PIECE CIRCULATORS

H MODELS | SUBMITTAL

DIMENSION DATA - INCHES (MM)

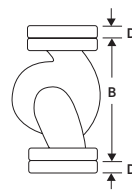
MODEL	FLANGE SIZE (N.P.T)	MOTOR**		DIMENSIONS INCHES (mm)				WEIGHT lbs (kg)
		HP	PHASE AND VOLT	A	B	C	D	
H32	1	3/8	1 PHASE 115 V	15.00 (381)	8.50 (216)	12.50 (318)	0.88 (22)	30 (13.6)
	1 1/4	3/8	1 PHASE 115 V	15.00 (381)	8.50 (216)	12.50 (318)	0.88 (22)	30 (13.6)
	1 1/2	3/8	1 PHASE 115 V	15.00 (381)	8.50 (216)	12.50 (318)	0.88 (22)	30 (13.6)
H41	1	3/8	1 PHASE 115 V	15.25 (387)	8.50 (216)	12.50 (318)	0.75 (19)	34 (15.4)
H51	1	3/4	1 PHASE 115 V	17.25 (438)	11.50 (292)	13.50 (343)	0.75 (19)	48 (21.8)
	1	3/4	3 PHASE 208-230/460 V	17.25 (438)	11.50 (292)	13.50 (343)	0.75 (19)	48 (21.8)
H52	1 1/4	3/8	1 PHASE 115 V	17.25 (438)	11.50 (292)	13.50 (343)	0.88 (22)	48 (21.8)
	1 1/4	3/8	3 PHASE 208-230/460 V	17.25 (438)	11.50 (292)	13.50 (343)	0.88 (22)	48 (21.8)
H53	1 1/2	1/2	1 PHASE 115 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	58 (26.3)
	1 1/2	1/2	3 PHASE 208-230/460 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	58 (26.3)
	1 1/2	1/2	3 PHASE 575 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	58 (26.3)
H54	2	3/4	1 PHASE 115 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	68 (30.8)
	2	3/4	3 PHASE 208-230/460 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	68 (30.8)
	2	3/4	3 PHASE 575 V	20.00 (508)	11.50 (292)	16.50 (419)	0.88 (22)	68 (30.8)
H63	1 1/2	1/2	1 PHASE 115 V	23.00 (584)	13.50 (343)	19.75 (502)	0.88 (22)	86 (39.0)
	1 1/2	1/2	3 PHASE 208-230/460 V	23.00 (584)	13.50 (343)	19.75 (502)	0.88 (22)	86 (39.0)
	1 1/2	1/2	3 PHASE 575 V	23.00 (584)	13.50 (343)	19.75 (502)	0.88 (22)	86 (39.0)
H64	1 1/2	3/4	1 PHASE 115 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	89 (40.4)
	1 1/2	3/4	3 PHASE 208-230/460 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	89 (40.4)
	1 1/2	3/4	3 PHASE 575 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	89 (40.4)
H65	1 1/2	1	1 PHASE 115 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	92 (41.7)
	1 1/2	1	3 PHASE 208-230/460 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	92 (41.7)
	1 1/2	1	3 PHASE 575 V	23.00 (584)	13.50 (343)	19.75(502)	0.88 (22)	92 (41.7)
H66	2	3/4	1 PHASE 115 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	110 (49.9)
	2	3/4	3 PHASE 208-230/460 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	110 (49.9)
	2	3/4	3 PHASE 575 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	110 (49.9)
H67	2	1	1 PHASE 115 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	115 (52.1)
	2	1	3 PHASE 208-230/460 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	115 (52.1)
	2	1	3 PHASE 575 V	23.25 (591)	14.00 (356)	19.75 (502)	0.88 (22)	115 (52.1)
H68	2	1 1/2	1 PHASE 115 V	21.75 (552)	14.00 (356)	18.25 (464)	0.88 (22)	120 (54.0)
	2	1 1/2	3 PHASE 208-230/460 V	21.75 (552)	14.00 (356)	18.25 (464)	0.88 (22)	120 (54.0)
	2	1 1/2	3 PHASE 575 V	21.75 (552)	14.00 (356)	18.25 (464)	0.88 (22)	120 (54.0)

Dimensions shown are for reference only. For exact dimensional data, contact factory.

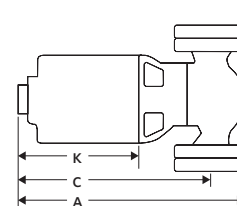
Companion flanges are not furnished as standard on s-25, s-45 and H-32. Conduit box not supplied on 1/2 hp or greater.

** All single phase motors are equipped with a built-in thermal overload protection. Three phase motors require external overload protection.

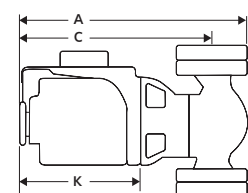
END VIEW



SIDE VIEW



RESILIENT MOUNT



S&H 3-PIECE CIRCULATORS

H MODELS | SUBMITTAL

COMPANION SINGLE FLANGE PART NUMBERS

SIZE	CAST IRON	LF BRONZE
¾	116013-011	116013-841
1	116012-011	116012-841
1¼	116011-011	116011-841
1½	116009-011	116009-841
2	105210-011/106074-011	105210-841/106074-841
2½	105189-011	105189-841
3	105188-011/133615-010	105188-841/106466-841

PART NUMBERS

MODEL	STANDARD DESIGN		MAINTENANCE FREE DESIGN	
	BRONZE FITTED	LEAD FREE* BRONZE	BRONZE FITTED	LEAD FREE* BRONZE
	ITEM NO.	ITEM NO.	ITEM NO.	ITEM NO.
H32	174034-013	174034LF-043	174034MF-013	174034MF-043
H41	174035-113	174035LF-143	174035MF-113	174035MF-143
H51 (1 Phase)	116431-132	116432LF-133	116431MF-132	116432MF-133
H51 (3 Phase)	110119-100	110119LF-101	110119MF-100	110119MF-101
H52 (1 Phase)	116435-132	116436LF-133	116435MF-132	116436MF-133
H52 (3 Phase)	110119-102	110119LF-103	110119MF-102	110119MF-103
H53 (1 Phase)	116439-132	116440LF-133	116439MF-132	116440MF-133
H53 (3 Phase)	116443-136	116444LF-137	116443MF-136	116444MF-137
H53 (3 pH 575 V)	116447-000	116448LF-000	116447MF-000	116448MF-000
H54 (1 Phase)	116451-132	116452LF-133	116451MF-132	116452MF-133
H54 (3 Phase)	116455-136	116456LF-137	116455MF-136	116456MF-137
H54 (3 pH 575 V)	116459-000	116460LF-000	116459MF-000	116460MF-000
H63 (1 Phase)	116463-132	116464LF-133	N/A	N/A
H63 (3 Phase)	116467-136	116468LF-137	N/A	N/A
H63 (3 pH 575 V)	116471-000	116472LF-000	N/A	N/A
H64 (1 Phase)	116475-132	116476LF-133	N/A	N/A
H64 (3 Phase)	116479-136	116480LF-137	N/A	N/A
H64 (3 pH 575 V)	116483-000	116484LF-000	N/A	N/A
H65 (1 Phase)	116487-132	116488LF-133	N/A	N/A
H65 (3 Phase)	116491-136	116492LF-137	N/A	N/A
H65 (3 pH 575 V)	116495-000	116496LF-000	N/A	N/A
H66 (1 Phase)	116499-132	116500LF-133	N/A	N/A
H66 (3 Phase)	116503-136	116504LF-137	N/A	N/A
H66 (3 pH 575 V)	116507-000	116508LF-000	N/A	N/A
H67 (1 Phase)	116511-132	116512LF-133	N/A	N/A
H67 (3 Phase)	116515-136	116516LF-137	N/A	N/A
H67 (3 pH 575 V)	116519-000	116520LF-000	N/A	N/A
H68 (3 Phase)	116523-136	116524LF-137	N/A	N/A
H68 (3 pH 575 V)	116527-000	116528LF-000	N/A	N/A

NOTE:

STANDARD DESIGN circulators are with Sleeve Bearing SBA and MAINTENANCE FREE DESIGN circulators are with ball bearing SBA.

1050 & 1060 3-PIECE CIRCULATORS

CUSTOM IN-LINE | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

PUMP DESIGN DATA

Pump model: _____ Flange size: _____
 No. of pumps: _____ Note: _____
 Capacity: _____ USgpm (L/s) Temperature: _____ °F (°C)
 Head: _____ ft (m) Liquid: _____
 Companion flanges: Included

MOTOR DESIGN DATA

kW: _____ RPM: 1800 Hertz: _____
 Frame size: _____ Enclosure: _____

MATERIALS OF CONSTRUCTION

PART NAME	BRONZE FITTED	ALL BRONZE
Pump body	Cast iron	Bronze

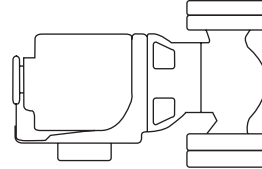
Impeller: SERIES 1050: Non-ferrous **Bearings:** Sleeve-oil lubricated
 SERIES 1060: Bronze
Shaft: Alloy steel-copper sleeve **Coupler:** Flexible spacer type
Mechanical seal assembly: Carbon/SiC, stainless steel trim, Viton seal

MAXIMUM PUMP OPERATING CONDITIONS

175 psig at 225°F (1207 kPa at 107°C)

MOUNTING ORIENTATION

The pump should be installed in a position to permit proper lubrication of bearings and servicing. Motor and bearing bracket are to be kept free of insulation. Pump and motor unit are designed to be supported by the in line piping only. Do not support in any other manner. A height of approximately 4 feet above floor is recommended.



HORIZONTAL MOUNTING

1050 & 1060 3-PIECE CIRCULATORS

CUSTOM IN-LINE | SUBMITTAL

MOTOR DATA - INCHES (MM)

PUMP SIZE	MOTOR		RESILIENT MOUNT INCHES (mm)			RIGID MOUNT INCHES (mm)			SHPG.WEIGHT lbs (kg)
	HP	PHASE AND VOLT	A	C	K	L	M	N	
1050	1/4	1 PHASE 115 V	17.25 (438)	13.50 (343)	7.38 (187)	—	—	—	48 (22)
	1/3					—	—	—	
	1/2	1 PHASE 115/230 V OR 3 PHASE 208- 230/460 V OR 575 V	19.75 (502)	16.00 (406)	9.88 (251)	—	—	—	58 (26)
	3/4					—	—	—	75 (34)
	1					—	—	—	80 (36)
1060 1.5D	1/2	1 PHASE 115/230 V OR 3 PHASE 208- 230/460 V OR 575 V	22.00 (559)	18.75 (476)	9.88 (251)	—	—	—	86 (39)
	3/4					—	—	—	82 (37)
	1					—	—	—	92 (42)
	1 1/2*	—	—	—	21.50 (546)	18.25 (464)	8.88 (225)	115 (52)	
	1060 2D	1/2	1 PHASE 115/230 V OR 3 PHASE 208- 230/460 V OR 575 V	22.75 (578)	19.25 (489)	9.88 (251)	—	—	—
3/4		—					—	—	96 (44)
1		—					—	—	100 (45)
1 1/2*		—	—	—	21.75 (552)	18.25 (464)	8.88 (225)	120 (54)	
2*		3 PHASE 208- 230/460 V OR 575 V	—	—	—	22.75 (578)	19.25 (489)	9.88 (251)	124 (56)
1060 3D	1	1 PHASE 115/230 V OR 3 PHASE 208- 230/460 V OR 575 V	—	—	—	23.50 (597)	18.50 (470)	8.88 (225)	135 (61)
	1 1/2*					24.00 (610)	19.00 (483)	8.88 (225)	138 (63)
	2*	3 PHASE 208- 230/460 V OR 575 V	—	—	—	25.00 (635)	20.00 (508)	9.88 (251)	143 (65)
	3*	—	—	—	—	27.75 (705)	22.75 (578)	9.88 (251)	150 (68)

DIMENSION DATA - INCHES (MM)

PUMP SIZE	FLANGE SIZE (N.P.T)	DIMENSIONS INCHES (mm)				
		B	D	E	F	H
1050 1B	1	11.50 (292)	0.75 (19)	1.38 (35)	3.75 (95)	4.12 (105)
1050 1.25B	1 1/4	11.50 (292)	0.88 (22)	1.38 (35)	3.75 (95)	4.12 (105)
1050 1.5B	1 1/2					
1050 2B	2					
1060 1.5D	1 1/2					
1060 2D	2	14.00 (356)	0.88 (22)	1.00 (25)	4.75 (121)	5.12 (130)
1060 3D	3	18.00 (457)	1.00 (25)	—	5.88 (149)	5.00 (127)

Dimensions shown are for reference only. For exact dimensional data, contact factory.

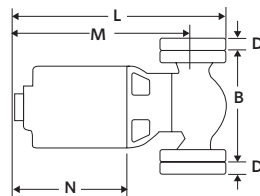
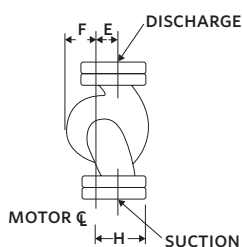
Pumps are shipped for up discharge.

Tapped openings are provided in the pump body for venting and draining.

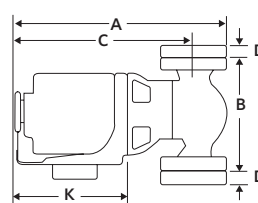
Motors are equipped with a built-in thermal overload protection. Motor resilient mount.

All single phase motors are equipped with a built-in thermal overload protection. Three phase motors rigid mount, require external thermal overload protection.

* Motors rigid mount.



RIGID MOUNT



RESILIENT MOUNT

1050 & 1060 3-PIECE CIRCULATORS

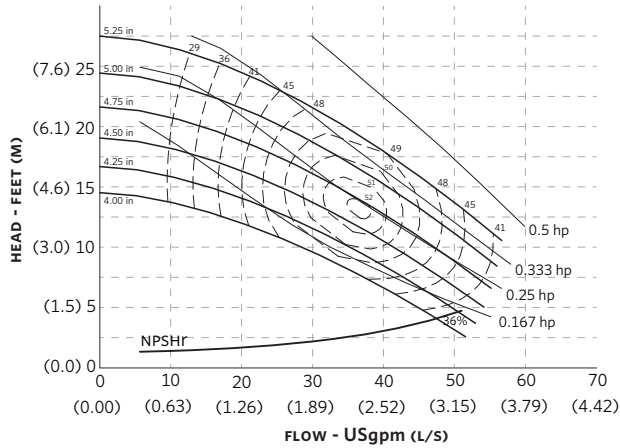
CUSTOM IN-LINE | SUBMITTAL

PERFORMANCE CURVE

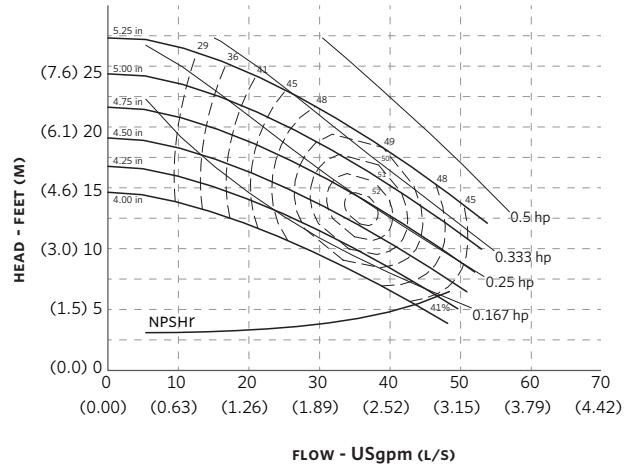
RPM: 1800 Availability: 1050 all ratings

- BHP based on shown Fluid's sp. gr.
- Performance guaranteed only at operating point indicated.
- Curve shown for clear, cold water - SP. GR. 1.0000

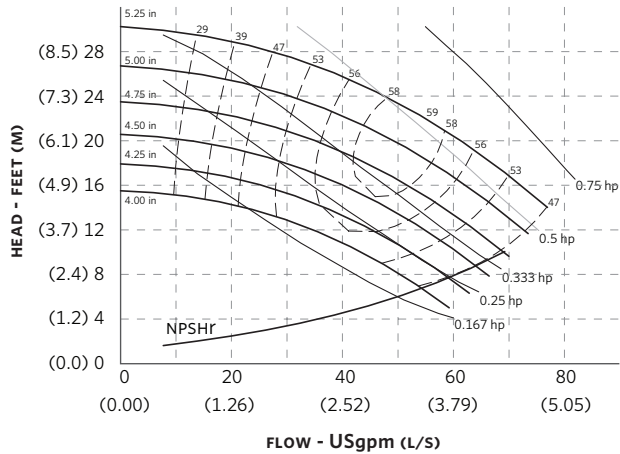
Curve number: PT25-0-0-1800 Size: 1B



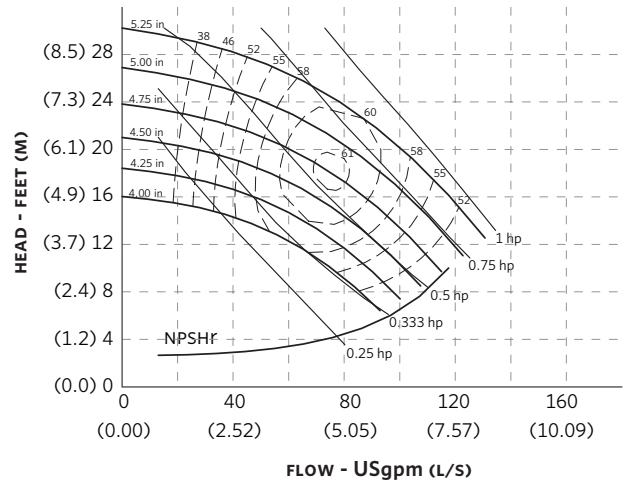
Curve number: PT1-1-0-1800 Size: 1.25B



Curve number: PT5-0-0-1800 Size: 1.5B



Curve number: PT26-0-0-1800 Size: 2B



1050 & 1060 3-PIECE CIRCULATORS

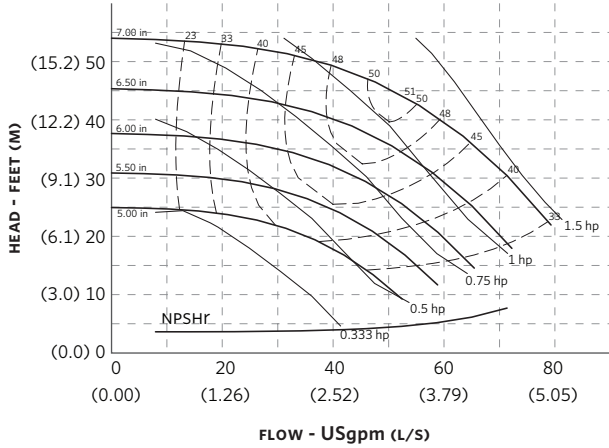
CUSTOM IN-LINE | SUBMITTAL

PERFORMANCE CURVE

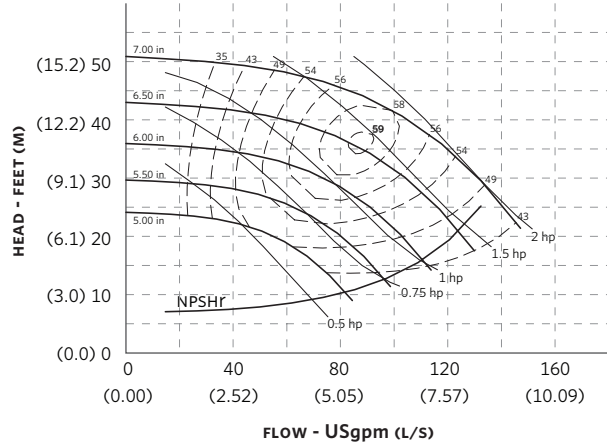
RPM: 1800 Availability: 1060 all ratings

- BHP based on shown Fluid's sp. gr.
- Performance guaranteed only at operating point indicated.
- Curve shown for clear, cold water - sp. gr. 1.0000

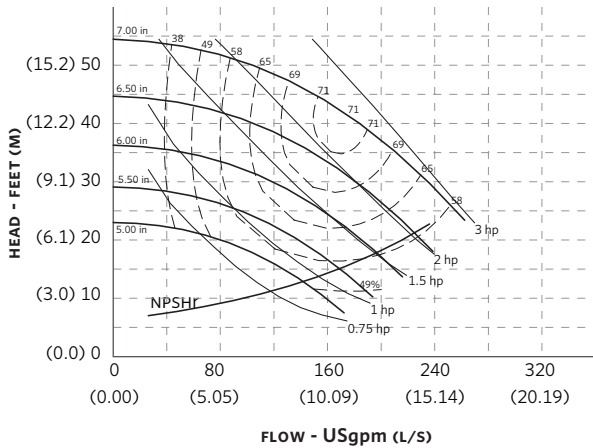
Curve number: PT8-O-O-1800 Size: 1.5D



Curve number: PT29-O-O-1800 Size: 2D



Curve number: PT41-O-O-1800 Size: 3D



E.2 CIRCULATORS | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Pump body: Cast iron (closed systems)
 Bronze (lead free for open systems)

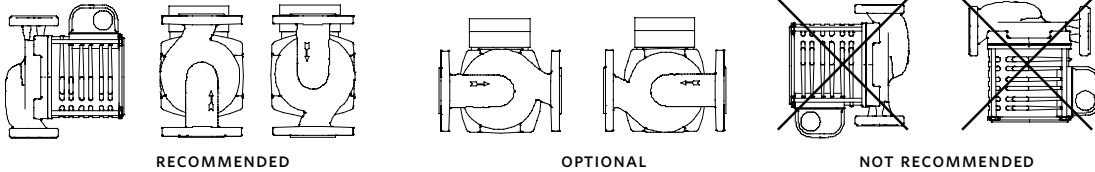
Face plate: Stainless steel **Shaft:** Stainless steel
Impeller: 30% Glass-filled noryl **Volute gasket:** EPDM
Bearings: Permanently lubricated stainless steel
Seal: Silicon carbide enviroseal c/w viton elastomer

TECHNICAL DATA

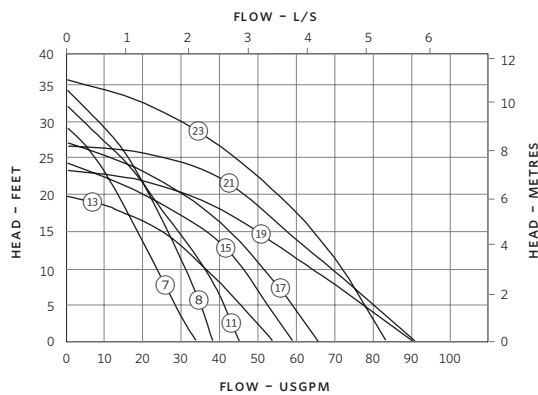
Flow range: 0 to 128.0 USgpm (0 to 8.1 L/s)
Head range: 0 to 61.0 feet (0 to 18.6 m)
Max/Min fluid temp: 230°F/40°F (110°C/4°C)
Max. Working pressure: 150 psi (1034 kPa)

MOUNTING ORIENTATION

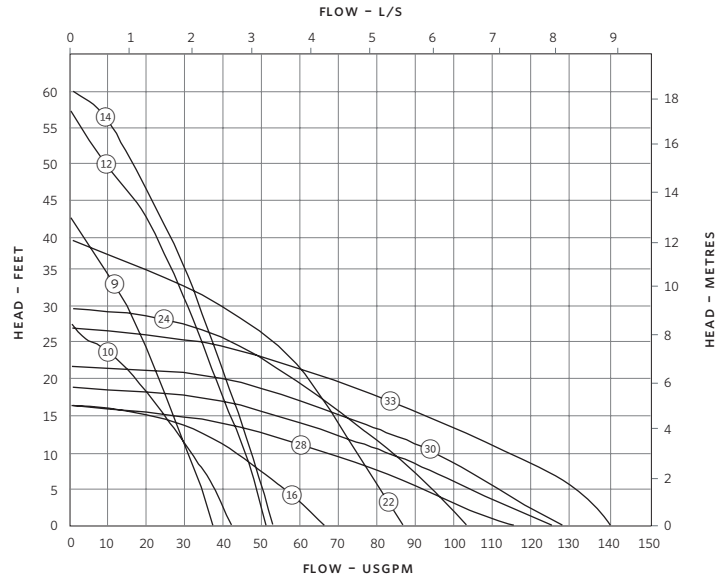
For indoor use only



PERFORMANCE CURVE



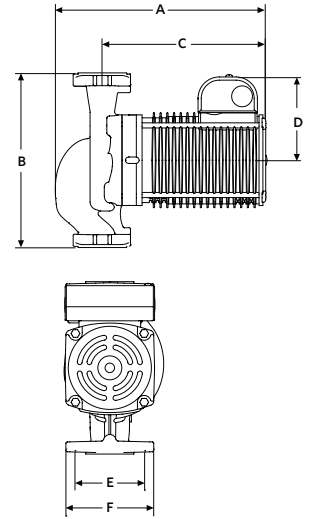
Circled numbers denote E.2 Series model number (Performance guaranteed only at operating point indicated).



E.2 CIRCULATORS | SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	BODY	CONNECTION TYPE & SIZE	DIMENSIONS INCHES (mm)						SHIPPING WEIGHT lbs (kg)							
			A	B	C	D	E	F								
E7.2	CAST IRON	1.25" diameter 2 bolt flanges	7.10 (180)	6.40 (164)	5.50 (140)	3.80 (97)	3.20 (81)	4.20 (107)	13.1 (5.94)							
E7.2B	BRONZE								13.3 (6.03)							
E8.2	CAST IRON								13.1 (5.94)							
E8.2B	BRONZE								13.3 (6.03)							
E9.2	CAST IRON								13.1 (5.94)							
E9.2B	BRONZE								13.3 (6.03)							
E10.2	CAST IRON	1.5" diameter 2 bolt flanges	7.50 (191)	8.50 (215)	5.60 (142)	3.80 (97)	3.40 (86)	4.20 (107)	15.1 (6.85)							
E10.2B	BRONZE															
E11.2	CAST IRON															
E11.2B	BRONZE															
E13.2	CAST IRON								14.8 (6.71)							
E13.2B	BRONZE															
E16.2	CAST IRON	2" diameter 4 bolt flanges	8.40 (212)	8.50 (215)	5.80 (147)	3.80 (97)	2.90 (73)	5.20 (131)	18.8 (8.53)							
E16.2B	BRONZE								20.9 (9.48)							
E30.2-2"	CAST IRON								17.2 (7.80)							
E30.2B-2"	BRONZE								25.7 (11.66)							
E30.2-3"	CAST IRON								26.8 (12.16)							
E30.2B-3"	BRONZE									29.2 (13.24)						
E33.2-2"	CAST IRON	2" diameter 4 bolt flanges	10.90 (276)	8.50 (215)	8.30 (210)	4.00 (101)	2.90 (73)	5.20 (131)	17.2 (7.80)							
E33.2B-2"	BRONZE								25.7 (11.66)							
E33.2-3"	CAST IRON								26.8 (12.16)							
E33.2B-3"	BRONZE									29.2 (13.24)						
E12.2	CAST IRON								1.25" diameter 2 bolt flanges	9.30 (235)	6.40 (164)	7.80 (197)	4.00 (101)	3.20 (81)	4.20 (107)	17.8 (8.07)
E12.2B	BRONZE															18.4 (8.35)
E14.2	CAST IRON	17.8 (8.07)														
E14.2B	BRONZE	18.4 (8.35)														
E15.2	CAST IRON	20.9 (9.48)														
E15.2B	BRONZE	21.2 (9.62)														
E17.2	CAST IRON	20.9 (9.48)														
E17.2B	BRONZE		21.2 (9.62)													
E19.2	CAST IRON	1.5" diameter 2 bolt flanges	10.30 (261)	8.50 (215)	8.00 (202)	4.00 (101)	3.40 (86)	4.20 (107)	20.7 (9.39)							
E19.2B	BRONZE								20.9 (9.48)							
E21.2	CAST IRON								20.7 (9.39)							
E21.2B	BRONZE								20.9 (9.48)							
E22.2	CAST IRON								20.7 (9.39)							
E22.2B	BRONZE								20.9 (9.48)							
E23.2	CAST IRON								20.7 (9.39)							
E23.2B	BRONZE								20.9 (9.48)							
E24.2	CAST IRON								20.7 (9.39)							
E24.2B	BRONZE								20.9 (9.48)							
E28.2	CAST IRON								3" diameter 4 bolt flanges	11.35 (286)	8.50 (215)	8.35 (210)	4.00 (101)	3.50 (89)	6.00 (152)	26.8 (12.16)
E28.2B	BRONZE															29.2 (13.24)
E29.2	CAST IRON	26.8 (12.16)														
E29.2B	BRONZE	29.2 (13.24)														



E.2 CIRCULATORS | SUBMITTAL

MOTOR DATA

MODEL	VOLTAGE	FULL LOAD AMP DRAW (A)	NOMINAL POWER (W)	FREQUENCY (HZ)	MOTOR TYPE	SPEED (RPM)		
E7.2/ E7.2B	120V	2.0	1/8 hp (125W)	60 Hz	Two pole, Single phase	3400		
E8.2/ E8.2B	208V	1.0				3250		
E9.2/ E9.2B	240V	1.0				3300		
E10.2/ E10.2B	120V	2.0				3300		
E11.2/ E11.2B						3400		
E13.2/ E13.2B						240V	1.0	3400
E16.2/ E16.2B						240V	1.0	3400
E30.2/ E30.2B	120V	4.1	1/2 hp (300W)		Two pole, Single phase ODP	3350		
	208V	2.4				3300		
	240V	2.4						
	277V	2.4						
E33.2/ E33.2B	120V	5.7			3300			
	208V	3.1						
	240V	3.1						
	277V	3.1						
E12.2/ E12.2B	120V	4.8		Two pole, Single phase	3500			
E14.2/ E14.2B								
E15.2/ E15.2B	120V	2.5		Two pole, Single phase ODP				
	208V	1.8						
	240V	1.8						
	277V	1.8						
E17.2/ E17.2B	120V	3.0	3450					
	208V	1.6						
	240V	1.6						
	277V	1.6						
E19.2/ E19.2B	120V	3.4				Two pole, Single phase ODP		
	208V	1.8						
	240V	1.8						
	277V	1.8						
E21.2/ E21.2B	120V	3.8			3350			
	208V	2.0						
	240V	2.0						
	277V	2.0						
E22.2/ E22.2B	120V	5.7		3400				
	208V	3.0						
	240V	3.0						
	277V	3.0						
E23.2/ E23.2B	120V	5.0	3450					
	208V	2.6						
E24.2/ E24.2B	240V	2.6				3400		
	277V	2.6						
E28.2/ E28.2B	120V	3.3				3400		
	208V	1.7						
	240V	1.7						
	277V	1.7						
E29.2/ E29.2B	120V	3.8			3400			
	208V	2.0						
	240V	2.0						
	277V	2.0						

E.2 CIRCULATORS | SUBMITTAL

PART NUMBERS

MODEL	120 V	240 V
E7.2	182202-643	182202-671
E7.2B	182202-644	182202-672
E8.2	182202-657	182202-645
E8.2B	182202-658	182202-646
E9.2	182202-659	182202-647
E9.2B	182202-660	182202-648
E10.2	182202-649	182202-661
E10.2B	182202-650	182202-662
E11.2	182202-651	182202-663
E11.2B	182202-652	182202-664
E13.2	182202-655	182202-667
E13.2B	182202-656	182202-668
E16.2	182202-653	182202-665
E16.2B	182202-654	182202-666
E30.2-2"	182212-645	182212-604
E30.2B-2"	182212-646	182212-605
E30.2-3"	182212-671	182212-630
E30.2B-3"	182212-672	182212-631
E33.2-2"	182222-669	182212-628
E33.2B-2"	182212-670	182212-629
E33.2-3"	182212-675	182212-634
E33.2B-3"	182212-676	182212-635
E12.2	182212-841	182212-800
E12.2B	182212-842	182212-801
E14.2	182212-843	182212-802
E14.2B	182212-844	182212-803
E15.2	182212-661	182212-620
E15.2B	182212-662	182212-621
E17.2	182212-663	182212-622
E17.2B	182212-664	182212-623
E19.2	182212-649	182212-608
E19.2B	182212-650	182212-609
E21.2	182212-665	182212-624
E21.2B	182212-666	182212-625
E22.2	182212-667	182212-626
E22.2B	182212-668	182212-627
E23.2	182212-651	182212-610
E23.2B	182212-652	182212-611
E24.2	182212-653	182212-612
E24.2B	182212-654	182212-613
E28.2	182212-655	182212-614
E28.2B	182212-656	182212-615
E29.2	182212-657	182212-616
E29.2B	182212-658	182212-617

ACCESSORIES

MODEL	FLANGE KITS
E7.2/ E7.2B E8.2/ E8.2B E9.2/ E9.2B E12.2/ E12.2B E14.2/ E14.2B E15.2/ E15.2B E17.2/ E17.2B	¾" Flange kits 1" Flange kits 1¼" Flange kits 1½" Flange kits
E10.2/ E10.2B E11.2/ E11.2B E13.2/ E13.2B E19.2/ E19.2B E21.2/ E21.2B E22.2/ E22.2B E23.2/ E23.2B E24.2/ E24.2B	1" Flange kits 1¼" Flange kits 1½" Flange kits
E16.2/ E16.2B E30.2-2" / E30.2-2"B E33.2-2" / E33.2-2"B E28.2/ E28.2B E29.2/ E29.2B	2" Flange kits
E30.2-3" / E30.2-3"B E33.2-3" / E33.2-3"B	3" Flange kits

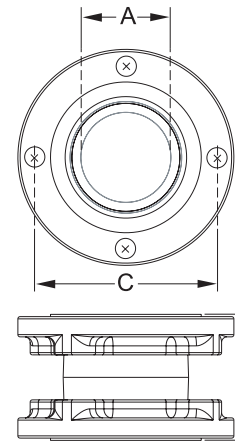
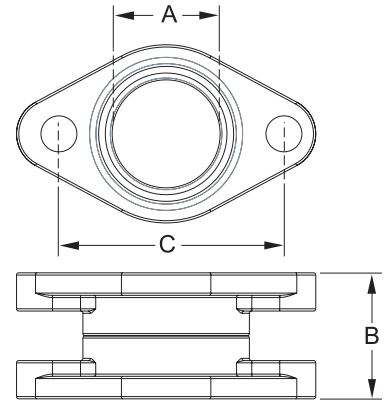
- Timer
- Aquastat
- Spool pieces

E.2 CIRCULATOR SPOOL PIECES | SUBMITTAL

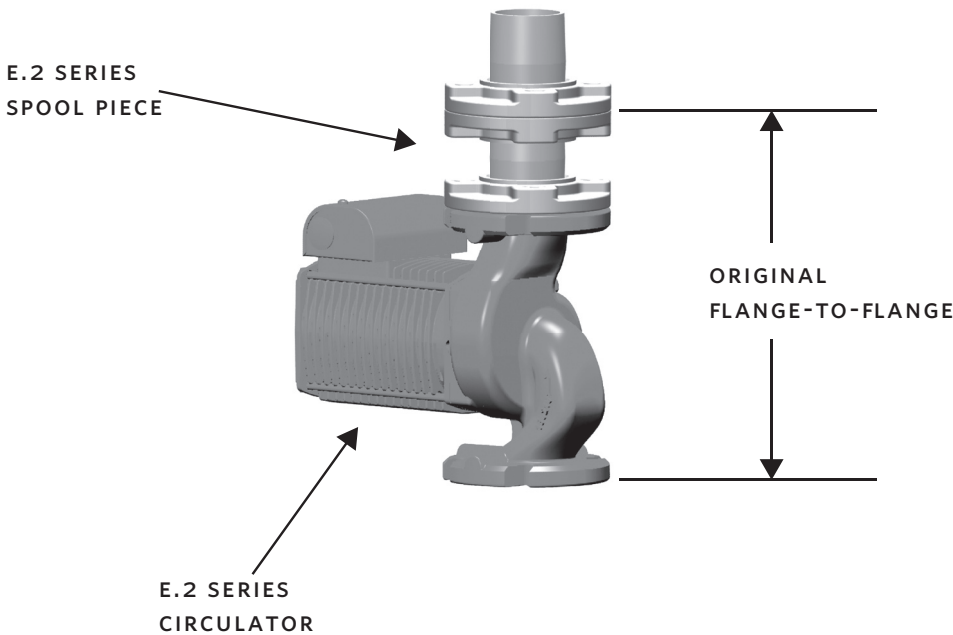


Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL	PIPE SIZE A inches (mm)	SPOOL LENGTH B inches (mm)	BOLT HOLES C inches (mm)	PART NO.
ESP-1	1.25 (32)	3.00 (75)	3.16 (80)	180221-011
ESP-2	1.25 (32)	2.50 (64)	3.16 (80)	180222-011
ESP-4	1.50 (38)	3.00 (75)	3.44 (87)	180224-011
ESP-5	1.50 (38)	5.00 (125)	3.44 (87)	180225-011
ESP-6	3.00 (75)	1.50 (38)	5.06 (129)	180226-011
ESP-7	3.00 (75)	2.62 (67)	5.06 (129)	180227-011
ESP-8	3.00 (75)	3.50 (89)	5.06 (129)	180228-011
ESP-9	3.00 (75)	5.12 (130)	5.06 (129)	180229-011
ESP-10	2.00 (50)	5.00 (125)	4.00 (100)	180230-011
ESP-11	1.50 (38)	2.50 (64)	3.44 (87)	180231-011
ESP-12	2.00 (50)	3.00 (75)	4.00 (100)	180232-011
ESP-13	2.00 (50)	5.50 (140)	4.00 (100)	180233-011



MOUNTING ORIENTATION



E.2 CIRCULATOR SPOOL PIECES | SUBMITTAL

PUMP MODEL TO BE REPLACED AND UPGRADED	UPGRADE WITH E MODEL +	ESP MODEL TO USE WITH E SERIES
BELL & GOSSETT		
2.5" / LD3	E28	ESP-6
HD3	E29	ESP-6
PD35	E30 - 3"	ESP-8
* 60-11	E17	ESP-2
* 60-15	E23	ESP-5
* 60-13	E24	ESP-4
60-14	E33 - 2"	ESP-12
* 601	E15	ESP-2
* 602	E17	ESP-2
* 607	E19	ESP-4
* 605	E21	ESP-2
* 622	E22	ESP-5
* 606	E24	ESP-11
615	E33 - 2"	ESP-10
PL55	E12	NOT REQUIRED
PL130 - 2"	E30 - 2"	NOT REQUIRED
PL130 - 3"	E30 - 3"	NOT REQUIRED
TACO		
121 / 122	E28	ESP-7
131	E29	ESP-9
132	E30 - 3"	ESP-9
133	E33 - 3"	ESP-9
1400-50	E12	NOT REQUIRED
1400-70	E33 - 2"	NOT REQUIRED
GRUNDFOS		
* UPS 32-80	E17	ESP-2
UP 43-70	E19	NOT REQUIRED
* UPS 32-160	E22	ESP-11
UP 43-110	E23	NOT REQUIRED
* UPS 40-80/2	E24	ESP-5
* UPS 50-80/2	E33 - 2"	ESP-12
ARMSTRONG		
* H51	E15	ESP-1
* H52	E17	ESP-1
* H63	E23	ESP-5
H53	E24	ESP-4
S45	E28	ESP-6
S46	E28	ESP-6
S55	E30 - 3"	ESP-8
H54	E33 - 2"	ESP-12

4270 PUMPS

MOTOR MOUNTED | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Construction: Bronze Fitted **O-ring:** Viton
Impeller: Ultem **Adapter:** Aluminum
Casing/Volute: Cast iron **Shaft:** 416 Stainless steel

MOUNTING ORIENTATION

Mount the pump on a foundation sufficiently substantial to absorb any vibration. A good foundation should weigh approximately two-and one-half times the shipping weight of the pump.

MAXIMUM PUMP OPERATING CONDITIONS

150 psig at 275°F (1034 kPa at 135°C)

MOTOR DESIGN DATA

kW: _____ **Hertz:** 60 Hz
Enclosure: 50J **Efficiency:** Standard
RPM: 3500

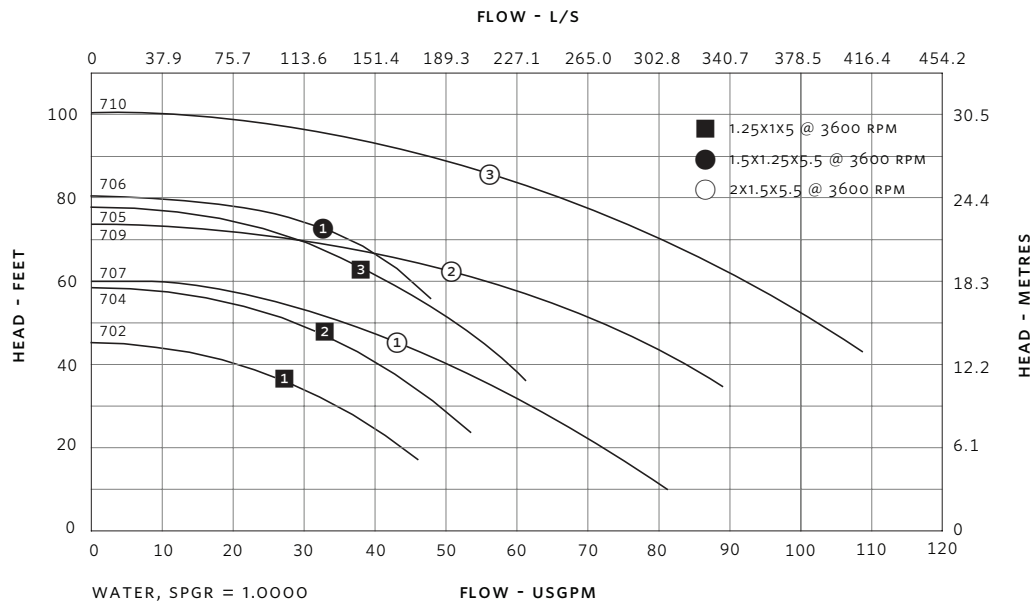
MECHANICAL SEAL DESIGN DATA

Seal type: 21 **L-cup:** Viton
Insert: Carbon **Retainer:** Stainless steel
Seal: Ceramic **Spring:** Stainless steel
Bellows: Viton

OPTIONAL EQUIPMENT

Flush line for vertical mounting

PERFORMANCE CURVE



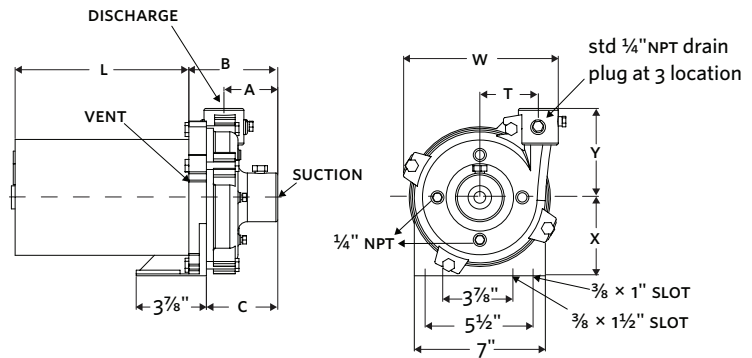
4270 PUMPS

MOTOR MOUNTED | SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	SUCTION	DISCHARGE	IMPELLER SIZE	MOTOR HP	DIMENSIONS INCHES (mm)								WEIGHT lbs (kg)	
					A	B	C	L*	T	W	X	Y		
702**	1.25 (31)	1.00 (25)	3.50 (88)	¾										38 (84)
704**	1.25 (31)	1.00 (25)	4.00 (100)	1	2.90 (73)	4.80 (121)	3.80 (95)	8.80 (222)	3.10 (79)	8.30 (210)	4.20 (106)	4.80 (121)		40 (88)
705**	1.25 (31)	1.00 (25)	4.50 (114)	1½										49 (108)
706**	1.50 (38)	1.25 (31)	4.50 (114)	2										51 (113)
707**	2.00 (50)	1.50 (38)	4.00 (100)	1½										53 (117)
709T	2.00 (50)	1.50 (38)	4.38 (111)	2	2.90 (73)	4.80 (121)	3.80 (95)	8.80 (222)	3.10 (79)	8.50 (216)	4.20 (106)	4.80 (121)		56 (124)
710T	2.00 (50)	1.50 (38)	5.00 (125)	3										60 (132)

All dimensions are in inches (mm) and weights in lbs (kg)
 *Motors are available with open drip-proof enclosures only.
 **Add suffix to the end of the model number.
 Suffix number: s: for 60 HZ - 1 phase - 115 v / 230 v (230 v only for 3 HP and 5 HP)
 T: for 60 HZ - 3 phase - 208-230 v / 460v



PART NUMBERS

MODEL	BRONZE FITTED	ALL BRONZE
702S	410133-201	410133-241
702T	410133-301	410133-341
704S	410133-203	410133-243
704T	410133-303	410133-343
705S	410133-204	410133-244
705T	410133-304	410133-344
706S	410134-200	410134-240
706T	410134-300	410134-340
707S	410135-200	410135-240
707T	410135-300	410135-340
709T	410135-302	410135-342
710T	410135-303	410135-343

4360 PUMP-IN-A-BOX

CLOSE-COUPLED VIL PUMPS | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Casing: Cast iron **Motor shaft:** Carbon steel
Companion flanges: Cast iron **Stub shaft (4360 B):** Stainless steel
Motor/pump bracket: Cast iron **Shaft sleeve (4360 D):** Bronze
Impeller: Bronze

TECHNICAL DATA

Maximum working pressure: 175 PSI (12 bar)
Maximum working temperature: 225°F (107°C)
 NPT END CONNECTIONS (COMPANION FLANGES INCLUDED)

MOTOR DESIGN DATA

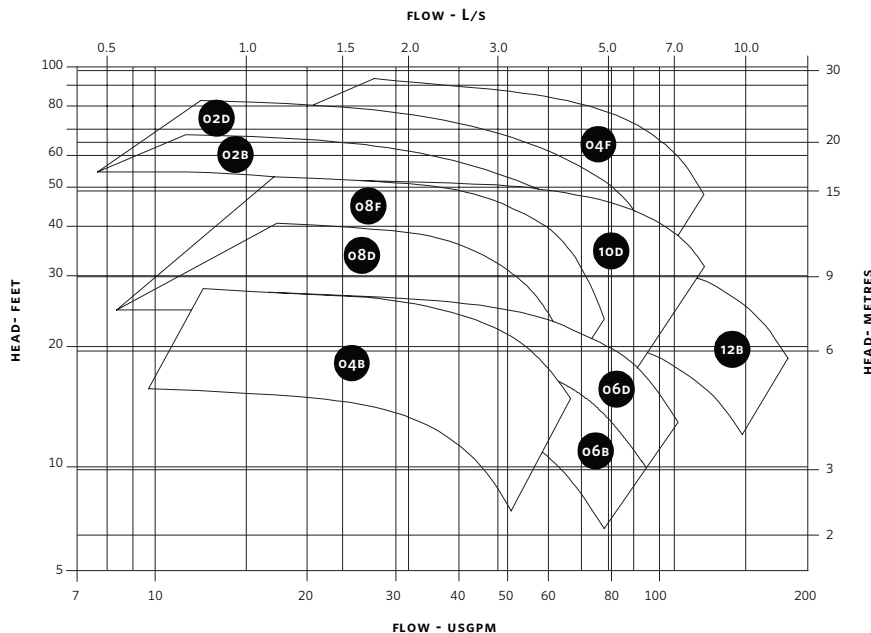
Frequency: 60 hz **Voltage:** See below **Enclosure:** ODP (4360B)
Efficiency: STD (4360B) TEFC (4360D)
 Energy efficient NEMA 12.11 (4360D)

MECHANICAL SEAL DESIGN DATA

STYLE	INSIDE SINGLE SPRING
Type	Armseal (4360B)
	Armstrong 2A (4360D)
Rotating face	Carbon
Stationary face	Ceramic (4360B)
	Silicon-carbide (4360D)
Secondary seal	BUNA-N (4360B)
	EPDM* (4360D)
Springs	Stainless steel
Rotating hardware	Stainless steel

* Not suitable for use on oil service

PERFORMANCE CURVE



4360 PUMP-IN-A-BOX

CLOSE-COUPLED VIL PUMPS | SUBMITTAL

MOTOR DATA - INCHES (MM)

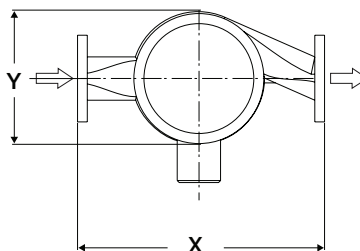
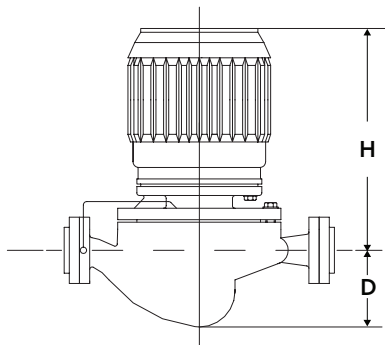
PERFORMANCE CURVE	MODEL	PART NUMBER		INLET & OUTLET (NPT)	HP
		208-230/460 VOLTS	575 VOLTS		
02B	4360B-1205T-1.5/2	4360B00AH-083	4360B00AH-068	1.25"×1.25"	Ⓢ1.5
02D	4360B-1205T-2.0/2	4360B00AJ-083	4360B00AJ-068	1.25"×1.25"	Ⓢ2
04B	4360B-1505T-0.5/4	4360B00BC-062 (115/230V ONLY)		1.5"×1.5"	Ⓢ0.5
04F	4360B-1505T-3.0/2	4360B00BM-083	4360B00BM-083	1.5"×1.5"	Ⓢ3
06B	4360B-2205T-0.5/4	4360B00CC-062 (115/230V ONLY)		2"×2"	Ⓢ0.5
06D	4360B-2205T-0.7/4	4360B00CD-068	4360B00CD-083	2"×2"	0.75
08D	4360D-1507T-1.0/4	4360D00AG-083	4360D00AG-068	1.5"×1.5"	1
08F	4360D-1507T-1.5/4	4360D00AI-083	4360D00AI-068	1.5"×1.5"	1.5
10D	4360D-2207T-2.0/4	4360D-2207T-2.0/4	4360D00BL-068	2"×2"	2
12B	4360D-3307T-1.5/4	4360D00CI-083	4360D00CI-068	3"×3"	1.5

DIMENSION DATA - INCHES (MM)

MODEL	DIMENSIONS - inches (mm)				WEIGHT lbs (kg)
	X	Y	H	D	
4360B-1205T-1.5/2	11.50 (292)	8.75 (222)	12.75 (324)	3.56 (90)	42 (19.0)
4360B-1205T-2.0/2	11.50 (292)	8.75 (222)	13.13 (334)	3.56 (90)	47 (21.3)
4360B-1505T-0.5/4	11.63 (295)	8.75 (222)	12.75 (324)	3.56 (90)	43 (19.5)
4360B-1505T-3.0/2	11.63 (295)	8.75 (222)	13.13 (334)	5.20 (132)	58 (26.3)
4360B-2205T-0.5/4	11.75 (298)	8.88 (226)	12.75 (324)	3.50 (89)	49 (22.2)
4360B-2205T-0.7/4	11.75 (298)	8.88 (226)	12.75 (324)	3.50 (89)	51 (23.1)
4360D-1507T-1.0/4	13.50 (343)	10.75 (273)	13.75 (349)	3.25 (83)	110 (49.9)
4360D-1507T-1.5/4	13.50 (343)	10.75 (273)	14.75 (375)	3.25 (83)	115 (52.2)
4360D-2207T-2.0/4	14.00 (356)	11.13 (283)	14.75 (375)	3.50 (89)	120 (54.4)
4360D-3307T-1.5/4	18.00 (457)	13.13 (334)	14.81 (376)	4.50 (114)	130 (59.0)

Note:

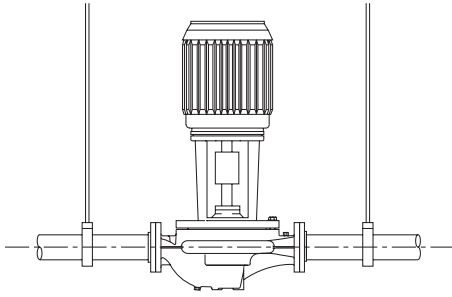
- A. For exact installation data please write factory for certified dimensions.
- B. All motors are 3-phase 1800 RPM except:
 - Ⓢ 3600 RPM
 - Ⓢ 1-phase



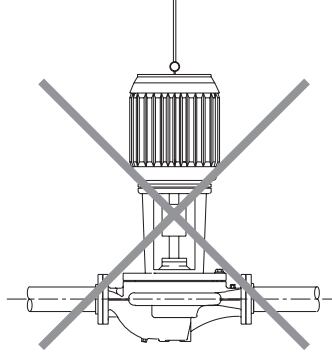
4360 PUMP-IN-A-BOX

CLOSE-COUPLED VIL PUMPS | SUBMITTAL

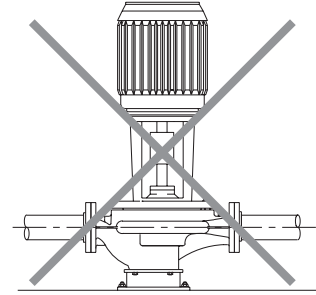
INSTALLATION



HANGER SUPPORTED PIPE MOUNTED



MOTOR LIFTING HOOK SUPPORTED



MOUNTED ON RIGID BASE WITHOUT FLEXIBLE CONNECTORS

4380 PUMP-IN-A-BOX

CLOSE-COUPLED VIL PUMPS | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Casing: Cast iron **Motor shaft:** Carbon steel
Companion flanges: Cast iron **Shaft sleeve:** Bronze
Impeller: Bronze **Gasket:** Non-asbestos fiber

TECHNICAL DATA

Maximum working pressure: 175 PSI (12 bar)
Maximum working temperature: 250°F (121°C)
Flange rating: ANSI 125

MECHANICAL SEAL DESIGN DATA

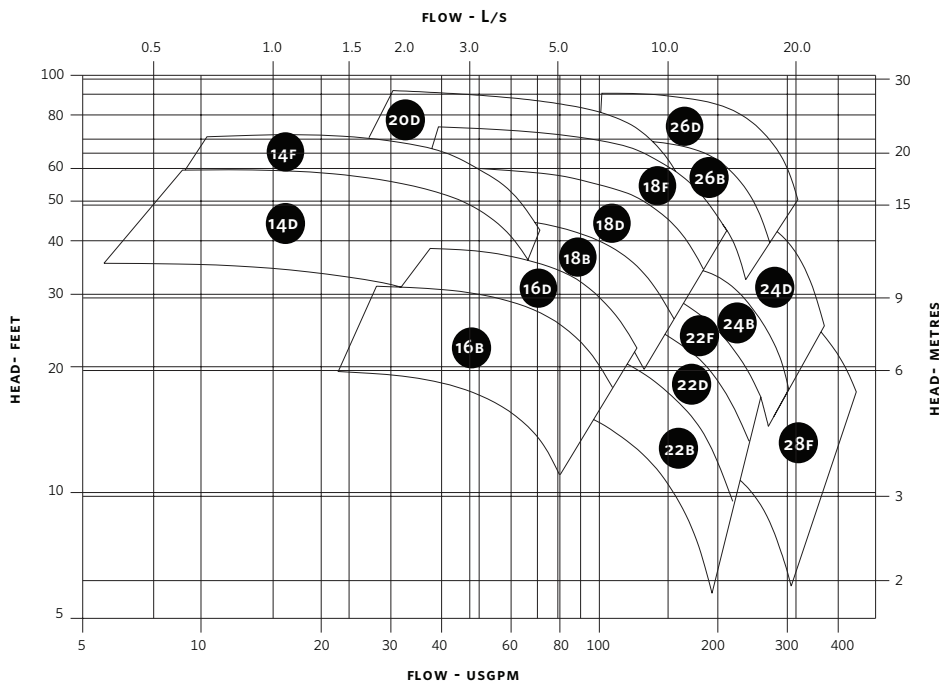
STYLE	INSIDE SINGLE SPRING
Type	Armstrong 2A
Rotating face	Carbon
Stationary face	Silicon-carbide
Secondary seal	EPDM*
Springs	Stainless steel
Rotating hardware	Stainless steel

* Not suitable for use on oil service

MOTOR DESIGN DATA

Frequency: 60 hz **Phase & voltage:** 3 PHASE 208-230/460 V OR 575 V
Enclosure: TEFC **Efficiency:** Energy efficient NEMA 12.11

PERFORMANCE CURVE



4380 PUMP-IN-A-BOX

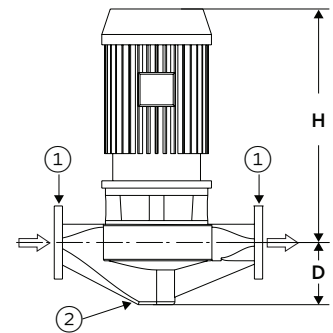
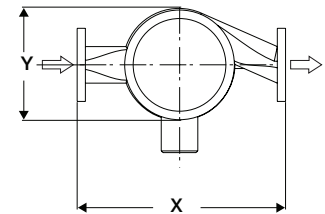
CLOSE-COUPLED VIL PUMPS | SUBMITTAL

MOTOR DATA - INCHES (MM)

PERFORMANCE CURVE	MODEL	PART NUMBER		INLET & OUTLET (ANSI 125)	HP
		208-230/460 VOLTS	575 VOLTS		
14D	4380-1508F-1.5/4	4380008AI-083	4380008AI-068	1.5"×1.5"	1.5
14F	4380-1508F-2.0/4	4380008AL-083	4380008AL-068	1.5"×1.5"	2
16B	4380-2206F-1.0/4	4380006BG-083	4380006BG-068	2"×2"	1
16D	4380-2206F-1.5/4	4380006BI-083	4380006BI-068	2"×2"	1.5
18B	4380-2208F-2.0/4	4380008BL-083	4380008BL-068	2"×2"	2
18D	4380-2208F-3.0/4	4380008BO-083	4380008BO-068	2"×2"	3
18F	4380-2208F-5.0/4	4380008BR-083	4380008BR-068	2"×2"	5
20D	4380-2210F-5.0/4	4380010AR-083	4380010AR-068	2"×2"	5
22B	4380-3306F-1.0/4	4380006CG-083	4380006CG-068	3"×3"	1
22D	4380-3306F-1.5/4	4380006CI-083	4380006CI-068	3"×3"	1.5
22F	4380-3306F-2.0/4	4380006CL-083	4380006CL-068	3"×3"	2
24B	4380-3308F-3.0/4	4380008CO-083	4380008CO-068	3"×3"	3
24D	4380-3308F-5.0/4	4380008CR-083	4380008CR-068	3"×3"	5
26B	4380-3310F-5.0/4	4380010BR-083	4380010BR-068	3"×3"	5
26D	4380-3310F-7.5/4	4380010BV-083	4380010BV-068	3"×3"	7.5
28F	4380-4406F-3.0/4	4380006DO-083	4380006DO-068	4"×4"	3

DIMENSION DATA - INCHES (MM)

MODEL	DIMENSIONS - inches (mm)				WEIGHT lbs (kg)
	X	Y	H	D	
4380-1508F-1.5/4	16.00 (406)	11.75 (298)	15.75 (400)	5.75 (146)	156 (70.8)
4380-1508F-2.0/4	16.00 (406)	11.75 (298)	15.75 (400)	5.75 (146)	156 (70.8)
4380-2206F-1.0/4	15.00 (381)	10.63 (270)	14.75 (375)	4.88 (124)	140 (63.5)
4380-2206F-1.5/4	15.00 (381)	10.63 (270)	15.75 (400)	4.88 (124)	145 (65.8)
4380-2208F-2.0/4	18.00 (457)	11.75 (298)	15.75 (400)	5.13 (130)	172 (78.0)
4380-2208F-3.0/4	18.00 (457)	12.75 (324)	20.13 (511)	5.13 (130)	187 (84.8)
4380-2208F-5.0/4	18.00 (457)	12.75 (324)	20.13 (511)	5.13 (130)	212 (96.2)
4380-2210F-5.0/4	19.00 (483)	13.75 (349)	20.13 (511)	5.38 (137)	245 (111.1)
4380-3306F-1.0/4	18.00 (457)	11.88 (302)	14.75 (375)	6.00 (152)	156 (70.8)
4380-3306F-1.5/4	18.00 (457)	11.88 (302)	6.00 (152)	6.00 (152)	161 (73.0)
4380-3306F-2.0/4	18.00 (457)	11.88 (302)	15.75 (400)	6.00 (152)	161 (73.0)
4380-3308F-3.0/4	22.00 (559)	13.88 (253)	20.13 (511)	6.38 (162)	213 (96.6)
4380-3308F-5.0/4	22.00 (559)	13.88 (253)	20.13 (511)	6.38 (162)	238 (108.0)
4380-3310F-5.0/4	21.00 (533)	14.25 (362)	20.13 (511)	6.25 (159)	282 (128.0)
4380-3310F-7.5/4	21.00 (533)	16.63 (422)	25.63 (651)	6.25 (159)	331 (150.1)
4380-4406F-3.0/4	22.00 (559)	13.88 (353)	20.38 (518)	7.75 (197)	213 (96.6)



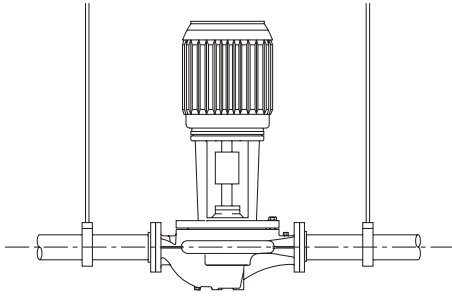
- ① ¼" NPT gauge tapings
- ② ¼" NPT drain

For exact installation data please write factory for certified dimensions.

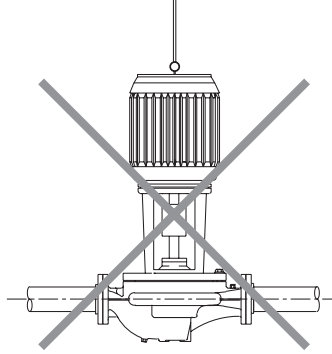
4380 PUMP-IN-A-BOX

CLOSE-COUPLED VIL PUMPS | SUBMITTAL

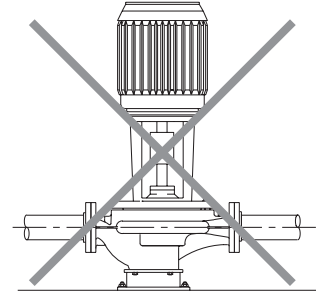
INSTALLATION



HANGER SUPPORTED PIPE MOUNTED



MOTOR LIFTING HOOK SUPPORTED



MOUNTED ON RIGID BASE WITHOUT FLEXIBLE CONNECTORS

DESIGN ENVELOPE 4300/4380 PUMP-IN-A-BOX

VERTICAL IN-LINE PUMPS | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Construction: BF with ANSI 125 flanged connection
Casing (volute): Cast iron (A48-30)
Casing gasket: Confined Non-Asbestos Fiber
Flush line: Braided Stainless Steel
Impeller: Bronze
Shaft sleeve (4380): Bronze
Pump shaft (4300): SS ASTM A276 Type 416

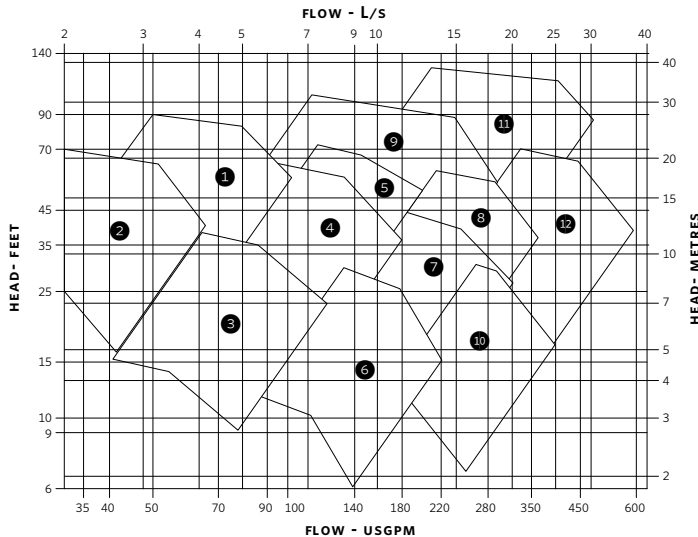
TECHNICAL DATA

Maximum working pressure: 175 PSI (12 bar)
Maximum working temperature: 250°F (121°C)

MOTOR DESIGN DATA

Frequency: 60 hz **Voltage:** 208-230
Enclosure: TEFC 460 v 575 v
Efficiency: NEMA PREMIUM 12.12

PERFORMANCE CURVE



DRIVE DATA

Sensorless control: Included
BMS protocol: BACnet MS/TP
Enclosure: UL type 12
Fused disconnect switch: No
Control orientation: L1
Communication port: RS 485
EMI/RFI control: Integrated filter designed to meet EN61800-3
Harmonic suppression: Integrated DC link reactors**
Cooling: Fan-cooled through back channel
Ambient temperature: -10°C to +45°C upto 1000 meters elevation (14°F to 113°F upto 3280FT)
Analog inputs: Two, current or voltage
Analog outputs: One, current
Digital inputs: Four programmable
Digital outputs: Two programmable

MECHANICAL SEAL DESIGN DATA

Seal type:	Inside single-spring (4380)
	Outside balanced (4300)
Secondary seal:	EPDM (4380)
	VITON (4300)
Rotating face:	Resin bonded carbon
Stationary seat:	Silicon-carbide
Springs:	Stainless steel
Rotating hardware:	Stainless steel

- Pump equipped with casing drain plug and ¼" NPT suction and discharge gauge ports

* If minimum maintained system pressure is not known, default is 40% of design head.
 ** The IVS 102 control is a low harmonic control with a built-in DC link reactor equivalent in performance to a 5% AC line reactor. This does not guarantee performance to any system wide harmonic specification or the costs to meet a system wide specification. If supplied with the system electrical details, Armstrong will run a computer simulation of the system wide harmonics. If system harmonic levels are exceeded, Armstrong can also recommend additional harmonic mitigation and the cost for such mitigation.

DESIGN ENVELOPE 4300/4380 PUMP-IN-A-BOX

VERTICAL IN-LINE PUMPS | SUBMITTAL

MOTOR DATA - INCHES (MM)

	DESIGN ENVELOPE MODEL	PART NUMBER			INLET & OUTLET ANSI 125	MOTOR DETAILS	
		208-230 VOLTS	460 VOLTS	575 VOLTS		HP*	FRAME
①	4380 1506-003.0	20212UEGBNSXXXXX	20214UEGBNSXXXXX	20215UEGBNSXXXXX	1.5"×1.5"	③ 3	182
②	4380 1508-001.5	22412UEGBNSXXXXX	22414UEGBNSXXXXX	22415UEGBNSXXXXX	1.5"×1.5"	1.5	145
③	4380 0206-001.5	21012UEGBNSXXXXX	21014UEGBNSXXXXX	21015UEGBNSXXXXX	2"×2"	1.5	145
④	4380 0208-003.0	22812UEGBNSXXXXX	22814UEGBNSXXXXX	22815UEGBNSXXXXX	2"×2"	3	182
⑤	4380 0208-005.0	22912UEGBNSXXXXX	22914UEGBNSXXXXX	22915UEGBNSXXXXX	2"×2"	5	184
⑥	4380 0306-001.5	21412UEGBNSXXXXX	21414UEGBNSXXXXX	21415UEGBNSXXXXX	3"×3"	1.5	145
⑦	4380 0308-003.0	23212UEGBNSXXXXX	23214UEGBNSXXXXX	23215UEGBNSXXXXX	3"×3"	3	182
⑧	4380 0308-005.0	23312UEGBNSXXXXX	23314UEGBNSXXXXX	23315UEGBNSXXXXX	3"×3"	5	184
⑨	4380 0310-007.5	24512UEGBNSXXXXX	24514UEGBNSXXXXX	24515UEGBNSXXXXX	3"×3"	7.5	213
⑩	4380 0406-003.0	21912UEGBNSXXXXX	21914UEGBNSXXXXX	21915UEGBNSXXXXX	4"×4"	3	182
⑪	4300 0308-015.0	04212UEGBNSXXXXX	04214UEGBNSXXXXX	04215UEGBNSXXXXX	3"×3"	⑮ 15	213-5TC
⑫	4300 0406-010.0	51712UEGBNSXXXXX	51714UEGBNSXXXXX	51715UEGBNSXXXXX	4"×4"	⑩ 10	213-5TC

*All motors are with NEMA premium 12.12 efficiency and TEFC enclosure.

Note: All motors are three-phase, four-pole except: ① Two-pole

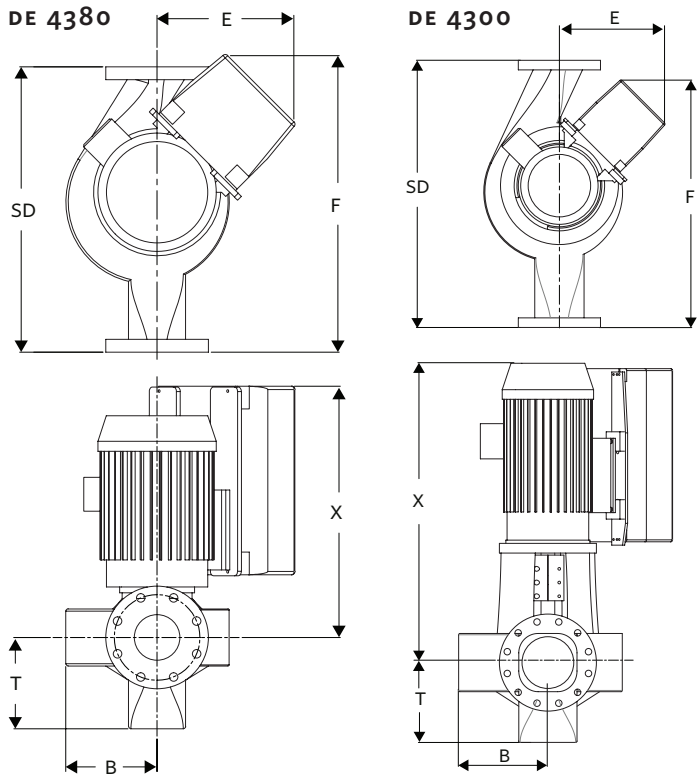
DIMENSION DATA - INCHES (MM)

	MODEL	DIMENSIONS - inches (mm)						WEIGHT lbs (kg)
		B	E	F	T	SD	X	
①	4380 1506-003.0	3.86 (98)	11.87 (301)	18.85 (479)	4.25 (108)	14.25 (362)	21.32 (542)	202 (91.6)
②	4380 1508-001.5	5.72 (145)	11.85 (301)	19.85 (504)	4.59 (117)	16.00 (406)	21.36 (543)	198 (89.8)
③	4380 0206-001.5	4.47 (114)	11.87 (301)	19.85 (504)	4.59 (117)	15.00 (381)	21.35 (542)	187 (84.8)
④	4380 0208-003.0	5.72 (145)	12.56 (319)	22.06 (560)	5.09 (129)	18.00 (457)	21.86 (555)	239 (108.4)
⑤	4380 0208-005.0	5.72 (145)	12.56 (319)	22.06 (560)	5.09 (129)	18.00 (457)	21.86 (555)	244 (110.7)
⑥	4380 0306-001.5	5.80 (147)	11.85 (301)	21.60 (549)	6.00 (152)	18.00 (457)	24.92 (633)	203 (92.1)
⑦	4380 0308-003.0	6.81 (173)	12.56 (319)	24.56 (624)	6.31 (160)	22.00 (559)	21.86 (555)	265 (120.2)
⑧	4380 0308-005.0	6.81 (173)	12.56 (319)	24.56 (624)	6.31 (160)	22.00 (559)	21.86 (555)	270 (122.5)
⑨	4380 0310-007.5	7.16 (182)	12.55 (319)	27.77 (705)	5.44 (138)	21.00 (533)	28.83 (732)	368 (166.9)
⑩	4380 0406-003.0	6.88 (175)	12.00 (305)	24.00 (610)	8.00 (203)	22.00 (559)	26.67 (758)	265 (120.2)
⑪	4300 0308-015.0	6.88 (175)	13.17 (335)	13.17 (335)	7.75 (197)	22.00 (559)	29.41 (747)	431 (195.5)
⑫	4300 0406-010.0	6.88 (175)	14.82 (376)	14.82 (376)	7.75 (197)	22.00 (559)	31.99 (812)	331 (150.1)

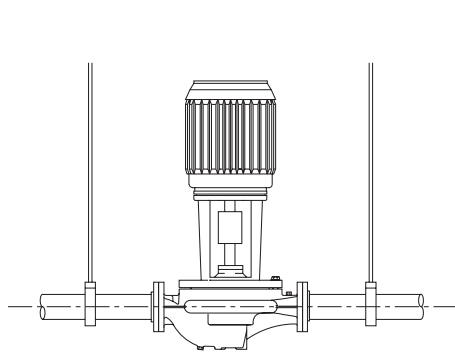
For exact installation data please write factory for certified dimensions.

DESIGN ENVELOPE 4300/4380 PUMP-IN-A-BOX

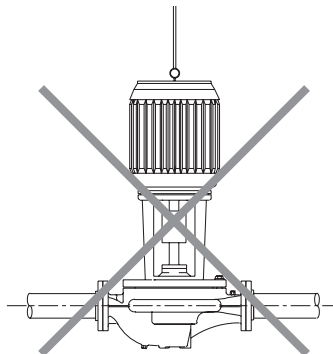
VERTICAL IN-LINE PUMPS | SUBMITTAL



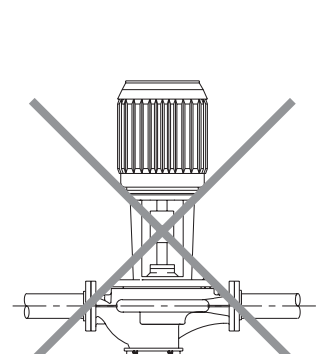
INSTALLATION



HANGER SUPPORTED PIPE MOUNTED



MOTOR LIFTING HOOK SUPPORTED



MOUNTED ON RIGID BASE WITHOUT FLEXIBLE CONNECTORS

AUTOMATIC AIR VENTS

HYDRONIC SPECIALTIES | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

QUANTITY	TAG NO.	MODEL NO.	COMMENTS

MATERIALS OF CONSTRUCTION

Body and cover: Brass Fitted

Internal components: Non-Ferrous

TECHNICAL DATA

Maximum working pressure: 150 psi (1034 kPa)

Maximum working temperature: 248°F (120°C)

Minimum working temperature: 15°F (-10°C)

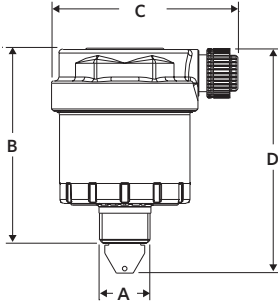
DIMENSION DATA - INCHES (MM)

MODEL	DESCRIPTION	DIMENSIONS INCHES (mm)				WEIGHT lbs (oz.)
		A	B	C	D	
AVA-013	Automatic Air Vent with angled discharge	1/8" NPT	2.06 (52)	1.88 (48)	2.25 (57)	0.20 (0.10)
AVA-025		1/4" NPT	2.06 (52)	1.88 (48)	2.25 (57)	
AVA-038		3/8" NPT	2.06 (52)	1.88 (48)	2.25 (57)	
AVA-050	Automatic Air Vent with angled discharge and service check valve	1/2" NPT	2.25 (57)	1.88 (48)	3.19 (81)	
AVA-075	Automatic Air Vent with angled discharge and M/F adapter	3/4" MPT	3.25 (83)	1.88 (48)	-	0.50 (0.28)
		1/2" FPT	3.25 (83)	1.88 (48)	-	
AVV-038	High capacity Automatic Air Vent with vertical discharge	3/8" NPT	2.94 (75)	1.88 (48)	3.25 (83)	0.35 (0.16)
AVV-050	High capacity Automatic Air Vent with vertical discharge and service check valve	1/2" NPT	3.25 (83)	1.88 (48)	4.19 (106)	
AVV-075	High capacity Automatic Air Vent with vertical discharge and M/F adapter	3/4" MPT	4.00 (100)	1.88 (48)	-	0.60 (0.22)
		1/2" FPT	4.00 (100)	1.88 (48)	-	

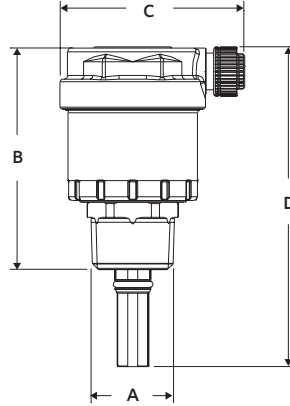
AUTOMATIC AIR VENTS

HYDRONIC SPECIALTIES | SUBMITTAL

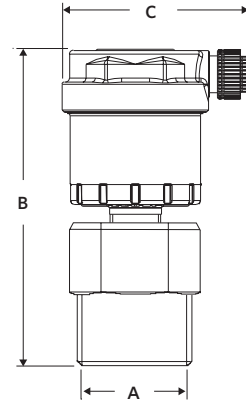
Models AVA-013, -025 & -038



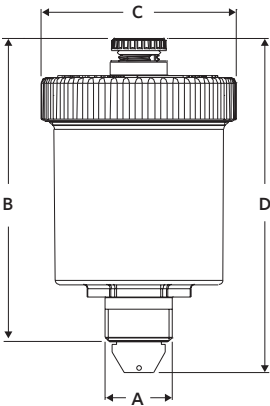
Models AVA-050 with service check valve



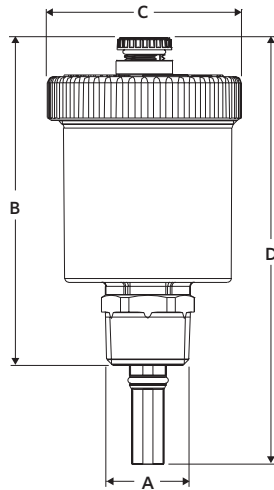
Models AVA-075



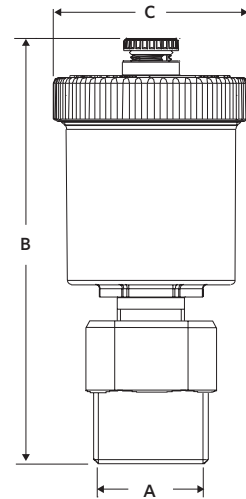
Models AVV-038



Models AVV-050 with service check valve



Models AVV-075



PART NUMBERS

MODEL	PART NUMBER
AVA-013	272005-300
AVA-025	272005-301
AVA-038	272005-302
AVA-050	272005-303
AVA-075	272005-308
AVV-038	272005-305
AVV-050	272005-306
AVV-075	272005-307

FLOAT TYPE AIR VENTS

HYDRONIC SPECIALTIES | SUBMITTAL

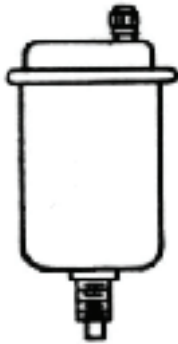


Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL NUMBER	PIPE SIZE	QUANTITY REQUIRED	IDENTIFICATION
67	1/8" (3.18)M		
71	1/4" (6.35)M		
72	1/8" (3.18)M		
75	1/2" (12.7)F & 3/4" (19.05)M		
7A overflow connector			

NO. 67 AUTO-VENT

Vertical mounting 1/8" I.P.
 Male connection.
 Up to 35 lbs. pressure
 3 3/4" x 1 1/16"



NO. 71 AUTO-VENT

Vertical mounting 1/4" NPT.
 Male connection.
 Up to 150 lbs. pressure
 4 3/8" x 2 1/4"



NO. 75 AUTO-VENT

Combination connection-
 1/2" NPT Female and
 3/4" NPT Male
 Up to 150 lbs. pressure



NO. 72 AUTO-VENT

Vertical or horizontal
 mounting 1/8" NPT
 Male connection
 Up to 75 lbs. pressure
 1 1/4" x 1/2"



NOTE: All dimensions are in inches (mm)

PART NUMBERS

MODEL	PART NUMBER
67	272005-004
71	272005-002
72	272005-005

MODEL	PART NUMBER
75	272005-003
7A	272005-006

AIR REMOVAL TRAP

HYDRONIC SPECIALTIES | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

DESIGN FEATURES

- One piece heavy cast iron construction
- Suitable for pipe-line mounting
- Units painted gray enamel
- Arrow indicates direction of flow
- Use #67 auto air vent at top of 1" (25.4 mm) - 1.5" (38.1 mm) purgers
- Use #75 auto air vent at top on 2" (50.8 mm) - 3" (76.2 mm)

MAXIMUM PUMP OPERATING CONDITIONS

125 psig at 225°F (1207 kPa at 107°C)

PART NUMBERS

MODEL	PART NUMBER
ART-447	572017-005
ART-448	572017-006

DIMENSION DATA - INCHES (MM)

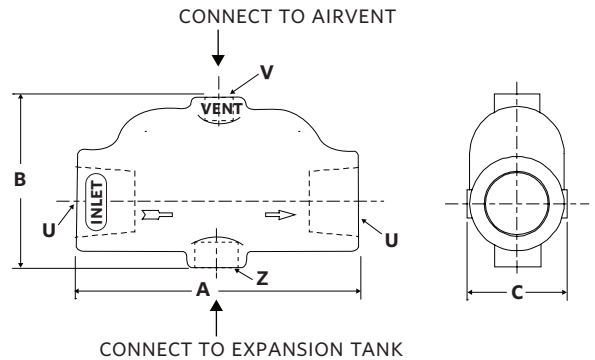
MODEL NO	PIPE SIZE	DIMENSIONS INCHES (mm)			TAPPINGS- N.P.T.			SHIPPING WEIGHT lbs (kg)
		A	B	C	U (N.P.T.)	V (N.P.T.)	Z (N.P.T.)	
ART-447	2.50 (63)	10.00 (254)	6.00 (152)	5.00 (127)	2.5 (63)	0.75 (19)	0.5 (13)	19 (8.62)
ART-448	3.00 (76)				3.00 (76)	0.75 (19)	0.5 (13)	20 (9.07)

All dimensions are in inches (mm) and weights in lbs (kg)
 Dimensions shown are for reference only

MOUNTING ORIENTATION

Install the unit ensuring the flow direction will match the arrow on the casing and the air vent connection is on top.

HORIZONTAL MOUNTED AIR SEPARATOR HAVING IN-LINE INLET & OUTLET DESIGNED FOR SEPARATION OF AIR IN HYDRONIC SYSTEMS.



DIAPHRAGM EXPANSION TANK

HYDRONIC SPECIALTIES | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

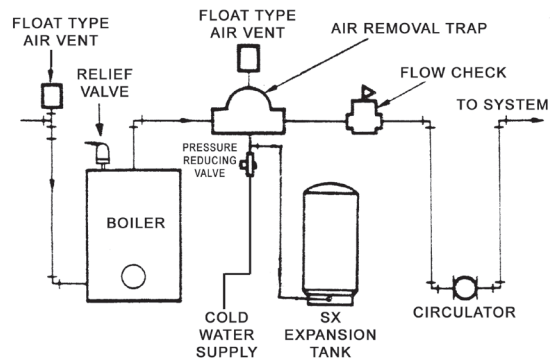
DESIGN FEATURES

- Permanent air cushion
- Mild steel shell
- Enamel finish
- Eliminates water logging
- Diaphragm separates 12 psi air cushion from expanding system water
- Saves space and installation costs
- Multiple unit installation for larger volume capacity

TECHNICAL DATA

- Maximum working pressure:** 100 psi (689 kPa)
- Maximum working temperature:** 240°F (116°C)
- Standard factory pre-charge (may be field adjusted):** 12 psi (83 kPa)

MOUNTING ORIENTATION



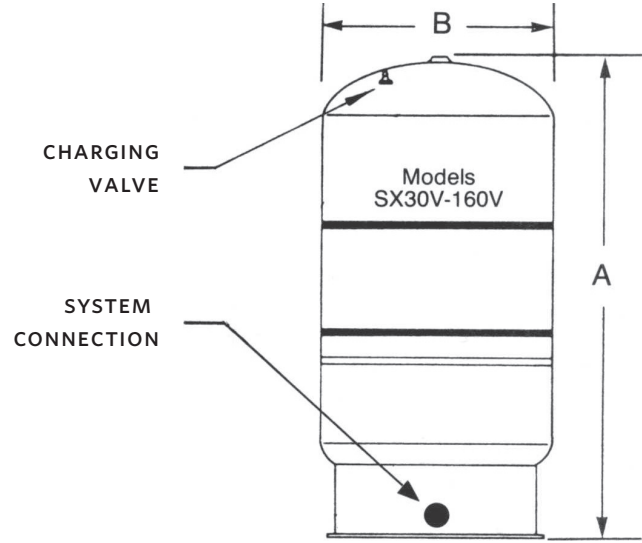
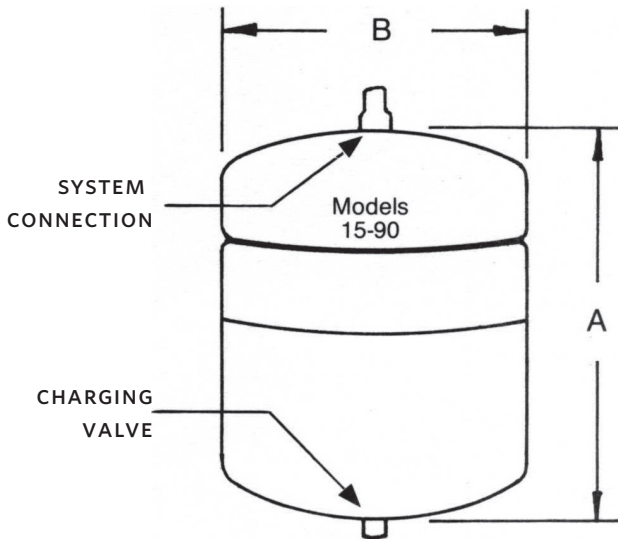
DIMENSION DATA - INCHES (MM)

TANKS MODEL NO.	SIZE		DIMENSIONS INCHES (mm)		SYSTEM CONN. (N.P.T)	WEIGHT lbs (kg)
	VOLUME (GAL.)	ACCEPT (GAL.)	A	B		
15	2	0.9	11.50 (292)	8.00 (203)	0.50 (13)	5 (2.27)
30	4.4	2.4	14.00 (356)	11.00 (279)	0.50 (13)	9 (4.08)
60	7.6	2.4	23.00 (584)	11.00 (279)	0.50(13)	14 (6.35)
90	14	11.3	21.00 (533)	15.00 (381)	0.50 (13)	23 (10.43)
sx-30v	14	11.3	24.00(610)	15.00 (381)	1.00 (25)	25 (11.34)
sx-40v	20	11.3	31.75 (806)	15.00 (381)	1.00 (25)	32 (14.51)
sx-60v	32	11.3	46.63 (1184)	15.00 (381)	1.00 (25)	45 (20.41)
sx-90v	45	34	36.00 (914)	22.00 (559)	1.25 (32)	70 (31.75)
sx-110v	62	34	46.50 (1181)	22.00 (559)	1.25 (32)	92 (41.73)
sx-160v	86	46	47.19 (1199)	26.00 (660)	1.25 (32)	113 (51.26)

All figures are nominal.
Do not use with fresh or potable water.

DIAPHRAGM EXPANSION TANK

HYDRONIC SPECIALTIES | SUBMITTAL

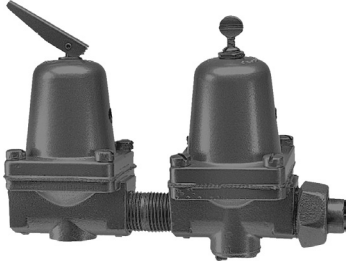


PART NUMBERS

MODEL	PART NUMBER
15	572018-001
30	572018-002
60	572018-003
90	572018-004
sx-30v	572018-005
sx-40v	572018-006
sx-60v	572018-007
sx-90v	572018-008
sx-110v	572018-009
sx-160v	572018-010

RELIEF AND REDUCING VALVES

HYDRONIC SPECIALTIES | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MOUNTING ORIENTATION

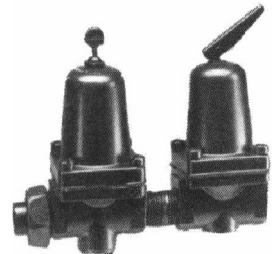
The pressure reducing valve should be installed with the flow arrow on the body pointing in the direction of the flow.

PART NUMBERS

MODEL	PART NUMBER	MODEL	PART NUMBER
C-11	216945-300	RD-40	207937-343
RL-11	216942-300	RD-50	207937-300
RD-11T/S	216944-300	HRD-70	207936-300

COMBINATION RELIEF AND REDUCING VALVE

Bodies have built-in strainer, extra large diaphragms, 1/2" (12.7mm) sweat or threaded union fitting and anti-siphon check valve feature on Reducing Valve. Reducing Valve is factory set at 12 psi but is easily adjusted to meet varying building heights. The special composition valve disc seat is brass and is practically noiseless during operation.



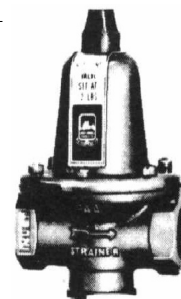
C-11

MODEL	SIZE		BODY CONSTRUCTION			BODY CONSTR.	APPROX SHIP. WEIGHT lbs (kg)
	BOILER	FILL	RELIEF VALVE	REDUCING VALVE			
				FACTORY SETTING DEL. PRESS.	READJUSTABLE RANGE		
C-11	1/2 (12.7)	1/2 (12.7)	30 (13.6)	12 (5.44)	7 to 25 (3.18 to 11.34)	Brass	2.25 (1.02)



RL-11

MODEL	SIZE	DESCRIPTION	BODY CONSTR.	APPROX SHIP. WEIGHT lbs (kg)
RL-11	1/2 (12.7)	Max setting- 30 lbs (13.61 kg)	Brass	1.25 (0.57)
RD-11T/S		REDUCING VALVES: All working parts are brass with easily cleaned built-in strainer. Factory adjusted at 12 psi suitable for buildings up to three stories high. Complete with integral check valve, the RD-11 is equipped with either a sweat or threaded tail piece on the inlet side.		
RD-40	3/4 (19.0)	HIGH PRESSURE REDUCING VALVE: Factory adjusted for 150 lbs initial pressure, 45 lbs delivery pressure. Other pressures must be specified when ordering. All working parts (built in strainer and extra large diaphragm) are brass. Complete with check valve.		3.25 (1.47)
RD-50*				
HRD-70				



RD-40
RD-50
HRD-70



RD-11

All dimensions are in inches (mm) and weights in lbs (kg)

* The same unit is used in Armstrong Combination valve.

CIRCUIT BALANCING VALVES

MINI SWEAT | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL NO.	QUANTITY	IDENTIFICATION

SPECIFICATION

Connection: Solder joint
Handwheel: 1 turn 360°

Material of construction: Brass

MAXIMUM PUMP OPERATING CONDITIONS

300 psig at 250°F (2068 kPa at 121°C)

DIMENSION DATA - INCHES (MM)

MODEL	PIPE SIZE	A	B	C	WEIGHT
CBV-½" MS	½"	3.12 (79)	3.53 (90)	1.34 (34)	1.10 (0.50)
CBV-¾" MS	¾"	3.78 (96)	3.62 (92)	1.34 (34)	1.19 (0.54)

All dimensions are in inches (mm) and weights are in lbs (kg)

Solder style models are supplied unassembled. Valve body must be soldered in the line before assembly.

Refer to Cv curves for sizing and balancing, giving pressure drop at different settings and flow rates.

Suggested meters for use in conjunction with Armstrong CBVs are the CBDM-200, CBDM-135/60, DPM-15 and DPM-100.

All valves furnished with probe metering ports.

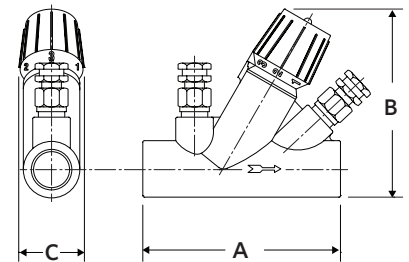
MOUNTING ORIENTATION

cbvs must be installed for flow in the direction of the arrow on the valve body and to allow easy access to the metering ports and handwheel.

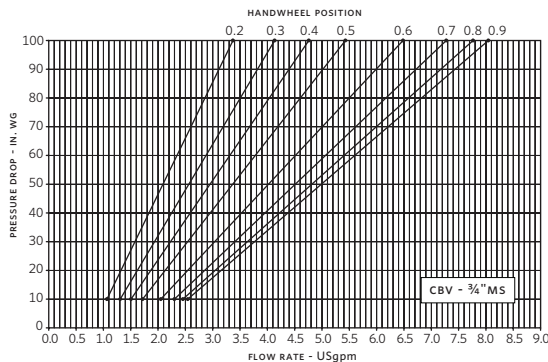
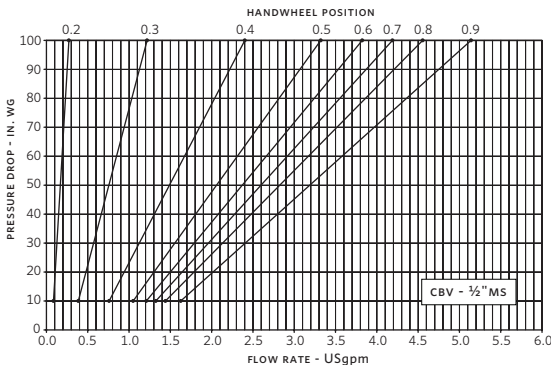
NOTE: We recommend that the valve be installed in such a way that the meter connections be above or on the side of the valve body. (Not below or at 6 o'clock).

PART NUMBERS

MODEL	PART NUMBER
CBV-½" MS	570109-332
CBV-¾" MS	570109-333

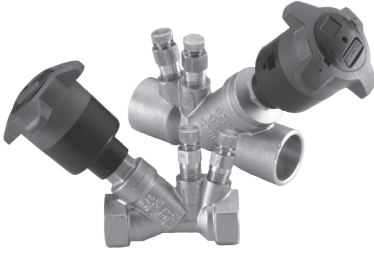


PERFORMANCE CURVE



CIRCUIT BALANCING VALVES

VENTURI | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Body, bonnet: Brass alloy (forged) - CW602N
 Corrosion resistant to reference EN12165 per ISO-6509

Stem and disc: Brass alloy (machined) - CW602N
 Corrosion resistant to reference EN12165 per ISO-6509

Elastomers: EPDM

Handwheel: Reinforced nylon; ABS

TECHNICAL DATA

Maximum working pressure: PN20 / 300 PSI (2068 kPa)

Operating temperature range: -4°F to 300°F (-20°C to 150°C)

FLOW RATE RANGES

MODEL	PIPE SIZE	MIN. FLOW RATE	MAX. FLOW RATE
CBV050V(X)CR-LF*	½" (DN15)	0.26 (0.02)	1.98 (0.12)
CBV075V(X)CR-LF*	¾" (DN20)	0.41 (0.03)	3.11 (0.20)
CBV050V(X)CR	½" (DN15)	1.22 (0.08)	9.57 (0.60)
CBV075V(X)CR	¾" (DN20)	1.99 (0.13)	13.76 (0.87)
CBV100V(X)CR	1" (DN25)	5.36 (0.34)	19.90 (1.25)
CBV125V(X)CR	1¼" (DN32)	8.45 (0.53)	40.01 (2.52)
CBV150V(X)CR	1½" (DN40)	9.02 (0.57)	50.07 (3.15)
CBV200V(X)CR	2" (DN50)	15.50 (0.98)	81.92 (5.16)

Flow in USgpm(L/s)
 Where model (X) = Connection Type: T = NPT, S = Sweat, B = BSPP (ISO-228).

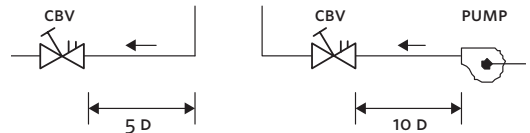
- * Armstrong low flow circuit balancing valves are needed for systems where the flow rate is below ASHRAE guidelines. Low flow units allow contractors to line size the valve, despite the low flow velocity. In addition, low flow valves:
- Boost the differential pressure signal to make the signal more stable and reliable
 - Provide superior flow regulation over the operating range
 - Are less prone to blockage due to particles in the system fluid
 - Accurately indicate a blockage condition

INSTALLATION

ARMflo Circuit Balancing Valves are highly resistant to turbulence induced by nearby piping components and can often provide excellent results when mounted directly to other fittings.

However, for optimum flow measurement accuracy and when practical, locate the valve:

- 5 pipe diameters downstream of a fitting.
- 2 pipe diameters upstream of a fitting.
- 10 pipe diameters upstream or downstream of a pump.



ACCESSORIES

PT ports	
PT port extensions	□ 1¼" □ 2¾"
Differential pressure manometers	CBDM 200
	CBDM 135/60
	DPM-15
	DPM-100

NOTES

- 1 Solder style models - Valve body must be opened at least one full turn prior to being soldered in the line.
- 2 For valve sizing, refer to the performance curve and flow rate ranges. For balancing, use Venturi Cv curves or slide rule, which display differential pressure drop across the Venturi for different flow rates.
- 3 Suggested differential pressure meters for use with Armstrong CBV's are DPM-15 and DPM-100 digital differential pressure meters and CBDM 135/60 and CBDM 200 analogue meters.
- 4 All valves furnished with probe metering ports.

CIRCUIT BALANCING VALVES

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DIMENSION DATA - INCHES (MM)

MODEL	PIPE SIZE	DIMENSIONS INCHES (mm)			WEIGHT lbs (kg)
		A	B	C	

SOLDER JOINT CONNECTION

CBV050VSCR-LF	½" (DN15)	3.19 (81)	4.56 (116)	2.76 (70)	1.05 (0.48)
CBV050VSCR					
CBV075VSCR-LF	¾" (DN20)	3.64 (93)	4.65 (118)	2.76 (70)	1.09 (0.49)
CBV075VSCR					
CBV100VSCR	1" (DN25)	4.26 (108)	4.95 (126)	2.76 (70)	1.68 (0.76)
CBV125VSCR	1¼" (DN32)	4.94 (125)	5.40 (137)	2.76 (70)	2.26 (1.03)
CBV150VSCR	1½" (DN40)	5.67 (144)	5.60 (142)	2.76 (70)	3.22 (1.46)
CBV200VSCR	2" (DN50)	7.03 (179)	6.36 (162)	2.76 (70)	5.40 (2.45)

THREADED CONNECTION

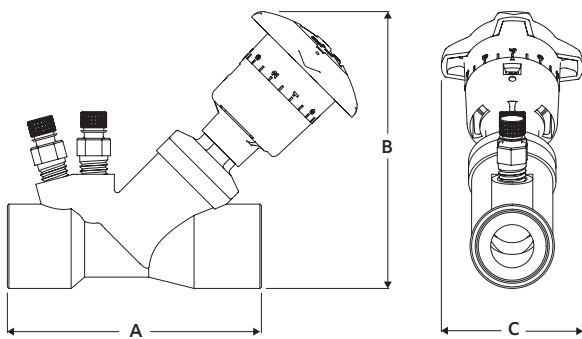
CBV050V(X)CR-LF	½" (DN15)	2.99 (76)	4.60 (117)	2.76 (70)	1.07 (0.49)
CBV050V(X)CR					
CBV075V(X)CR-LF	¾" (DN20)	3.26 (83)	4.90 (125)	2.76 (70)	1.21 (0.55)
CBV075V(X)CR					
CBV100V(X)CR	1" (DN25)	3.80 (97)	5.29 (135)	2.76 (70)	1.86 (0.84)
CBV125V(X)CR	1¼" (DN32)	4.32 (110)	5.60 (143)	2.76 (70)	2.34 (1.06)
CBV150V(X)CR	1½" (DN40)	5.07 (129)	5.90 (150)	2.76 (70)	3.49 (1.59)
CBV200V(X)CR	2" (DN50)	6.00 (153)	6.68 (170)	2.76 (70)	5.97 (2.46)

All dimensions are in inches (mm) and weights in lbs (kg)
Where model (x) = Connection Type: T = NPT or B = BSPP (ISO-228).

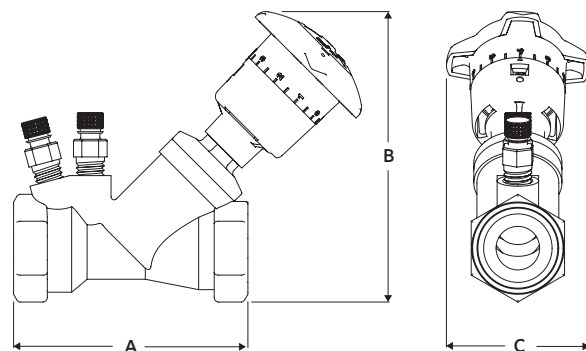
PART NUMBERS

MODEL	PART NUMBER
CBV050V(S)CR-LF	571109-370
CBV050V(T)CR-LF	571109-360
CBV050V(B)CR-LF	571110-530
CBV050V(S)CR	571109-350
CBV050V(T)CR	571109-340
CBV050V(B)CR	571110-520
CBV075V(S)CR-LF	571109-371
CBV075V(T)CR-LF	571109-361
CBV075V(B)CR-LF	571110-531
CBV075V(S)CR	571109-351
CBV075V(T)CR	571109-341
CBV075V(B)CR	571110-521
CBV100V(S)CR	571109-352
CBV100V(T)CR	571109-342
CBV100V(B)CR	571110-522
CBV125V(S)CR	571109-353
CBV125V(T)CR	571109-343
CBV125V(B)CR	571110-523
CBV150V(S)CR	571109-354
CBV150V(T)CR	571109-344
CBV150V(B)CR	571110-524
CBV200V(S)CR	571109-355
CBV200V(T)CR	571109-345
CBV200V(B)CR	571110-525

SOLDER JOINT CONNECTION



THREADED CONNECTION

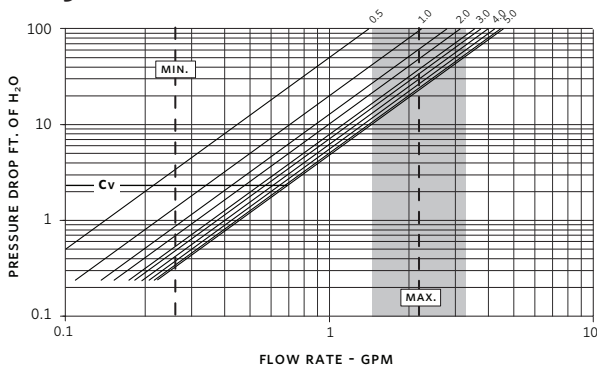


CIRCUIT BALANCING VALVES

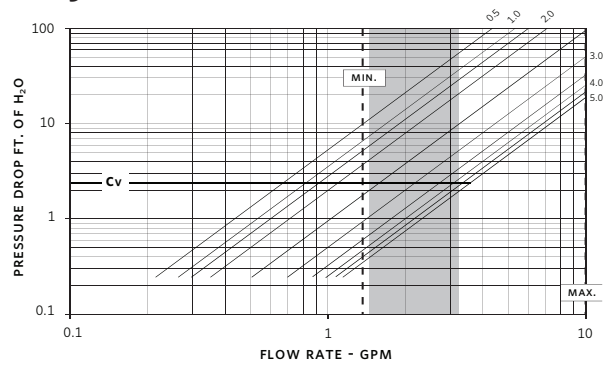
VENTURI | SUBMITTAL

PERFORMANCE CURVES

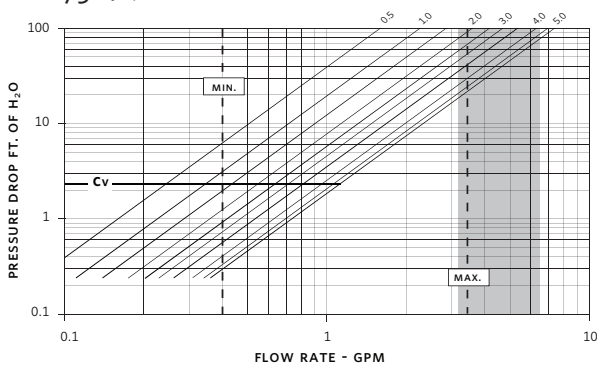
CBV050V(X)CR-LF



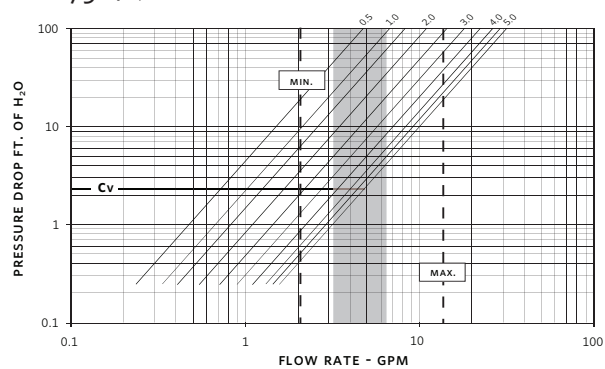
CBV050V(X)CR



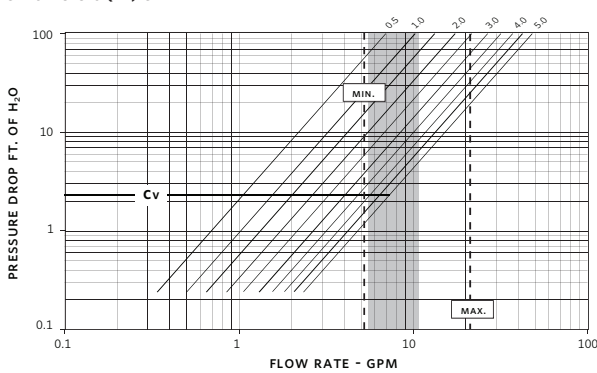
CBV075V(X)CR-LF



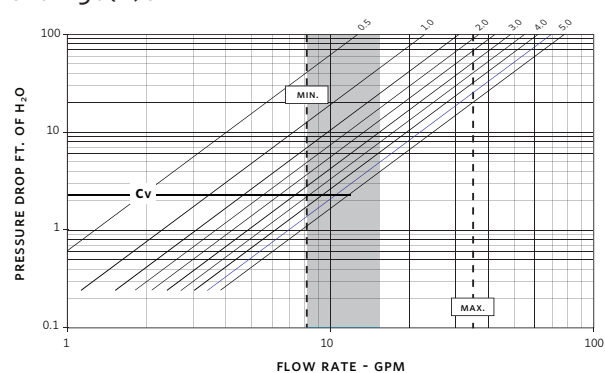
CBV075V(X)CR



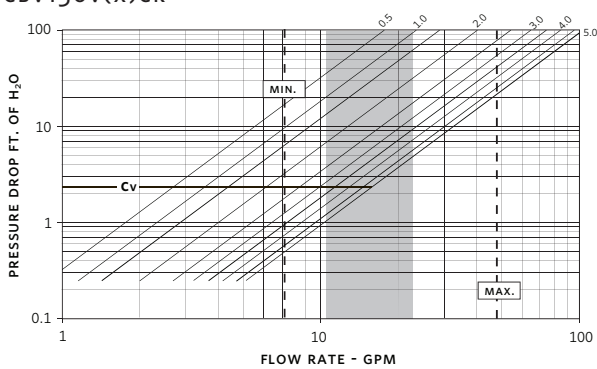
CBV100V(X)CR



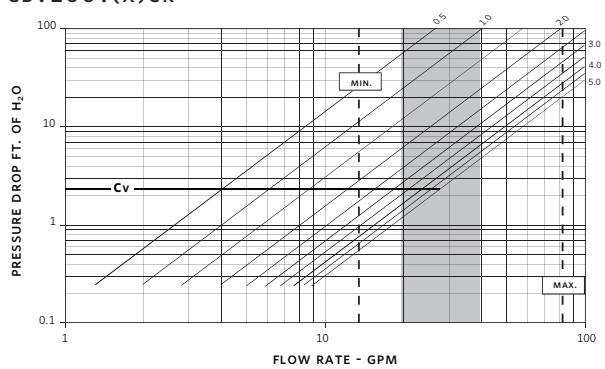
CBV125V(X)CR



CBV150V(X)CR

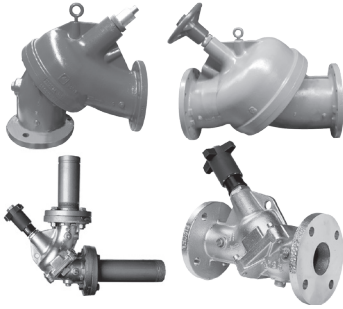


CBV200V(X)CR



CIRCUIT BALANCING VALVES

ANSI FLANGED | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Body: Cast iron ASTM A48 class 30B **Disk:** Bronze ASTM B584 C-84400
Seat: EPDM** elastomer **Stem:** Brass - ASTM B -16
Trim: Brass ASTM B283 C-37700 **O-ring:** Buna & EPDM** elastomer
Insulation: Optional fibre glass insulation with PVC cover

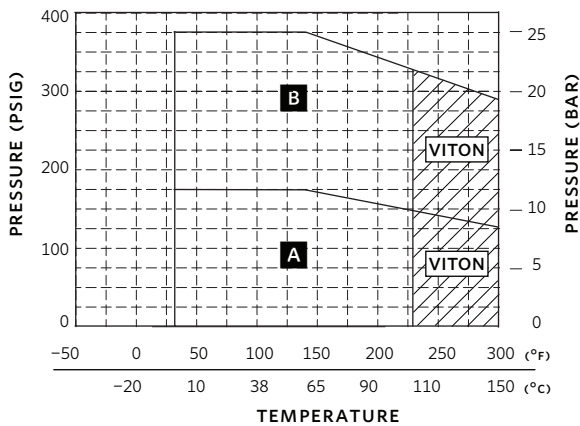
** EPDM is not suitable for oil service.

MAXIMUM PUMP OPERATING CONDITIONS

175 psig at 230°F (1207 kPa at 110°C*)

*Optional Viton for 2½" to 6" sizes elastomers for temperatures up to 300°F (150°C)

OPERATING PARAMETERS



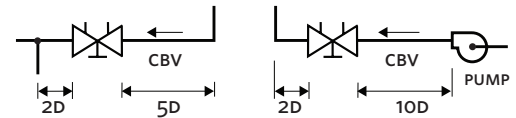
LEGEND: **A** 2.5" - 12" ANSI 125 FLANGE
B 8" - 12" ANSI 250 FLANGE

DESIGN DATA CBV STRAIGHT AND ANGLE

PIPE SIZE	STEM: NO. OF 360° TURNS	PIPE SIZE	STEM: NO. OF 360° TURNS
2.5	5	6	6
3	5	8	12
4	6	10	10
5	6	12	14

INSTALLATION

Generally locate the valve five pipe diameters downstream from a fitting; with two diameters downstream from the balancing valve free from fittings. If a balancing valve is located downstream from a circulation pump, allow a distance of ten (10) diameters between the pump and balancing valves (as illustrated below). To save space, the valve may be used in the angled configuration as an elbow.



ACCESSORIES

PT ports	
PT port extensions	□ 1¾" □ 2¾"
Differential pressure manometers	CBDM 200 CBDM 135/60 DPM-15 DPM-100

Orifice Plates: 2½" to 12"

Venturis: 2½" to 12" butt welded

Pre-formed insulation is available to meet ASTM D 1784/Class T4253-C, MEA # 7-87, ASTM E-84 and ASTM E-136 with a flame spread rating of 25 or less and a smoke development rating of 50 or less.

CIRCUIT BALANCING VALVES

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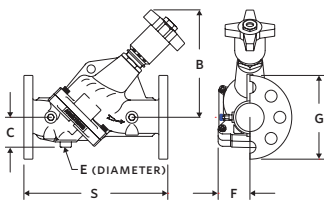
DIMENSION DATA - INCHES (MM)

MODEL	PIPE SIZE	DIMENSIONS INCHES (mm)								WEIGHT lbs (kg)
		A	B (FULL OPEN)	C	D	E	F	G	S	
125 # ANSI FLANGE										
CBV-2½FS	2.5	7.38	9.62 (244)	2.75	4.63	1.00	2.56	7.00	12.00	33
CBV-2½FA		(187)		(70)	(118)	(25)	(65)	(178)	(305)	(15)
CBV-3FS	3	8.19	10.50 (267)	2.44	3.88	1.00	3.00	7.50	12.00	39
CBV-3FA		(208)		(62)	(99)	(25)	(76)	(191)	(305)	(17.7)
CBV-4FS	4	9.63	10.56 (268)	3.00	4.38	1.25	3.44	9.00	14.00	59
CBV-4FA		(245)		(76)	(111)	(32)	(87)	(229)	(356)	(26.8)
CBV-5FS	5	12.00	13.06 (332)	3.63	5.50	1.25	4.94	10.00	17.50	108
CBV-5FA		(305)		(92)	(140)	(32)	(125)	(254)	(445)	(49)
CBV-6FS	6	14.13	13.75 (349)	4.44	6.63	2.00	5.88	11.00	20.69	167
CBV-6FA		(359)		(113)	(168)	(51)	(149)	(279)	(526)	(75.7)
CBV-8FS	8	19.00	24.62 (625)	5.69	9.19	2.25	7.88	13.50	28.00	344
CBV-8FA		(483)		(145)	(233)	(57)	(200)	(343)	(711)	(156)
CBV-10FS	10	20.33	26.50 (673)	6.56	9.78	2.25	9.47	16.00	30.01	603
CBV-10FA		(516)		(167)	(248)	(57)	(241)	(406)	(762)	(273)
CBV-12FS	12	24.07	28.43 (722)	7.63	14.05	2.25	12.63	19.00	38.09	1006
CBV-12FA		(611)		(194)	(357)	(57)	(321)	(483)	(967)	(456)

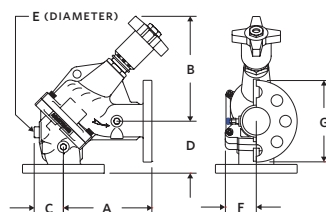
250 # ANSI FLANGE										
CBV-8FS	8	19.11	24.62 (625)	5.69	9.69	2.25	7.88	15.00	28.20	396
CBV-8FA		(485)		(145)	(246)	(57)	(200)	(380)	(716)	(180)
CBV-10FS	10	20.33	26.50 (673)	6.56	9.80	2.25	9.47	17.50	30.01	712
CBV-10FA		(516)		(167)	(249)	(57)	(241)	(445)	(762)	(323.6)
CBV-12FS	12	24.05	28.43 (722)	7.63	14.03	2.25	12.63	20.50	38.05	1163
CBV-12FA		(611)		(194)	(356)	(57)	(321)	(521)	(966)	(528.6)

NOTE: All dimensions are in inches (mm) and weights in lbs (kg). Dimensional tolerance up to ±0.125" (3mm).

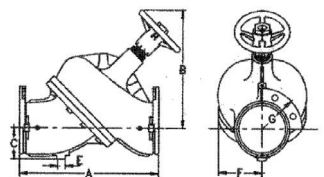
MODEL CBV-FS - 2.5" TO 6"



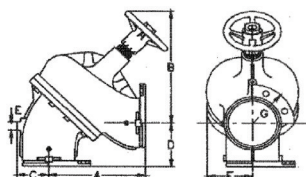
MODEL CBV-FA - 2.5" TO 6"



MODEL CBV-FS - 8" TO 12"



MODEL CBV-FA - 8" TO 12"



CIRCUIT BALANCING VALVES

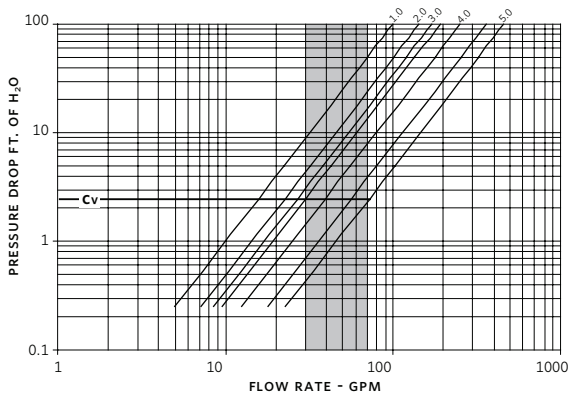
ANSI FLANGED | SUBMITTAL

PART NUMBERS

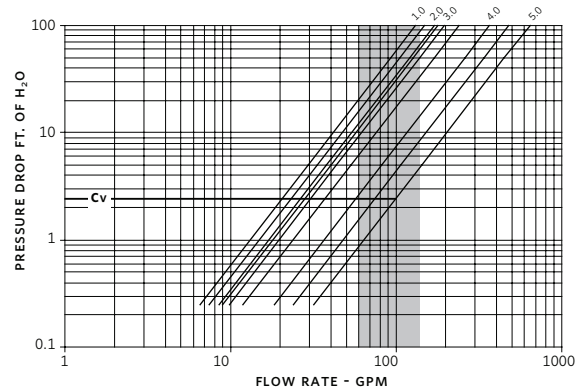
MODEL	PART NUMBER	MODEL	PART NUMBER
CBV-2½FS	570109-376	CBV-10FS-125#	570109-382
CBV-2½FA	570109-476	CBV-10FA-125#	570109-482
CBV-3FS	570109-377	CBV-10FS-250#	570109-662
CBV-3FA	570109-477	CBV-10FA-250#	570109-682
CBV-4FS	570109-378	CBV-12FS-125#	570109-383
CBV-4FA	570109-478	CBV-12FA-125#	570109-483
CBV-5FS	570109-379	CBV-12FS-250#	570109-663
CBV-5FA	570109-479	CBV-12FA-250#	570109-683
CBV-6FS	570109-380		
CBV-6FA	570109-480		
CBV-8FS-125#	570109-381		
CBV-8FA-125#	570109-481		
CBV-8FS-250#	570109-661		
CBV-8FA-250#	570109-681		

PERFORMANCE CURVES

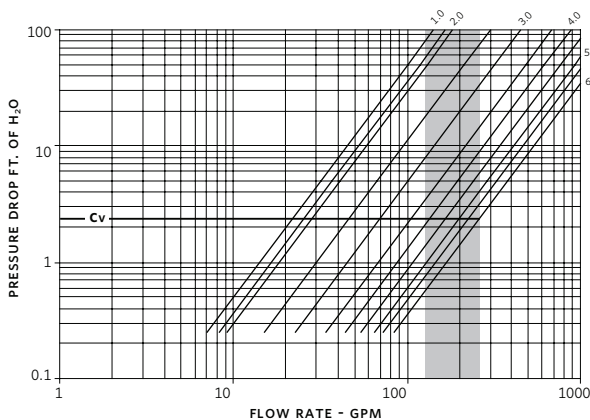
CBV-2½FS/CBV-2½FA



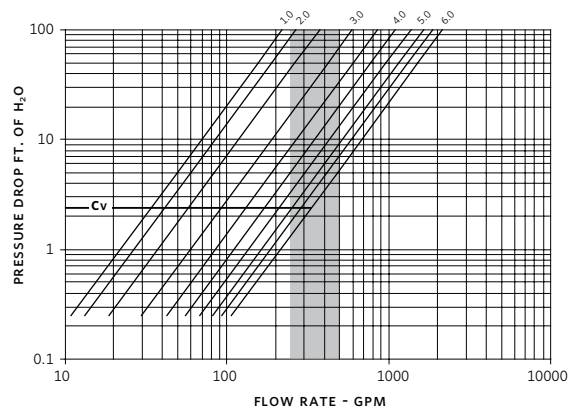
CBV-3FS/CBV-3FA



CBV-4FS/CBV-4FA



CBV-5FS/CBV-5FA

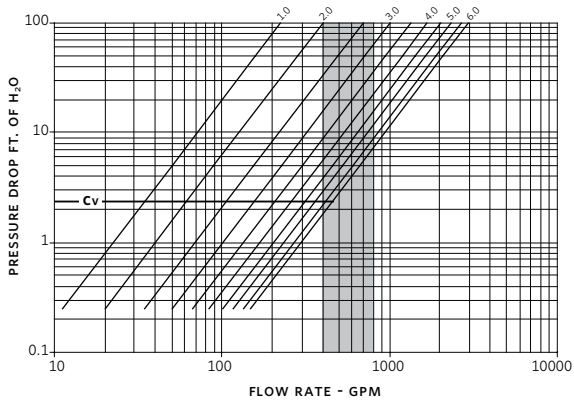


CIRCUIT BALANCING VALVES

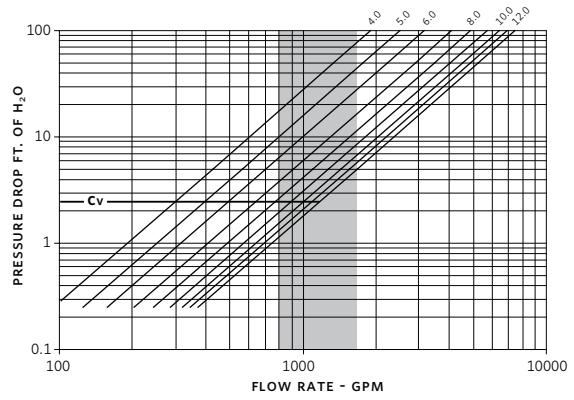
ANSI FLANGED | SUBMITTAL

PERFORMANCE CURVES

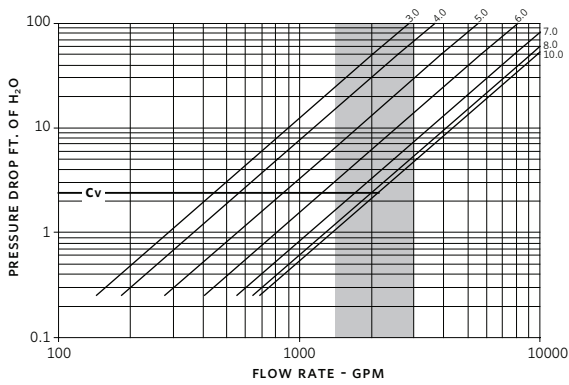
CBV-6FS/CBV-6FA



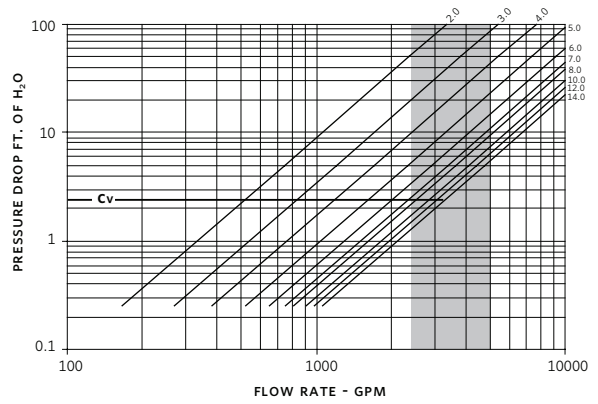
CBV-8FS/CBV-8FA



CBV-10FS/CBV-10FA

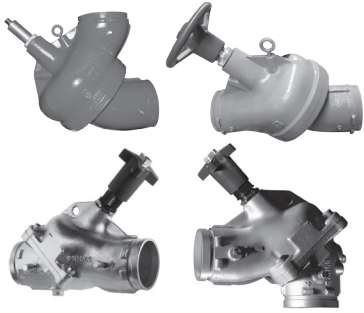


CBV-12FS/CBV-12FA



CIRCUIT BALANCING VALVES

ANSI GROOVED | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

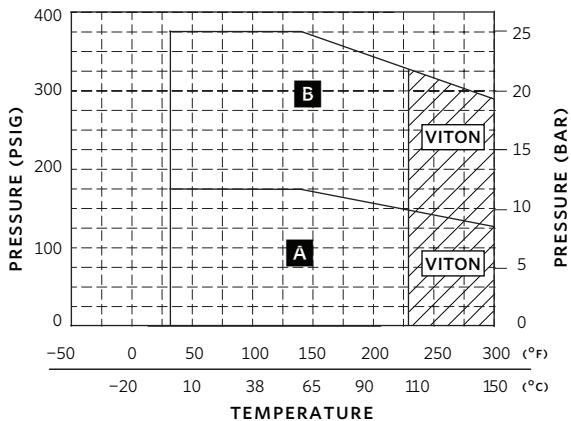
MATERIALS OF CONSTRUCTION

- Body:** Ductile iron ASTM A536 GR65-45-12
 - Disk:** Bronze ASTM B584 C-84400
 - Seat:** Ultra high strength engineered resin
 - Stem:** 2½" - 4" - Brass - ASTM B -16
 5" - 12" - Stainless steel ASTM A582 type 416
 - Trim:** Brass C-37700
 - O-ring:** Buna
 - Insulation:** Optional (pre-formed insulation is available to meet ASTM D 1784/class T4253-C, MEA # 7-87, ASTM E-84 and ASTM E-136 with a flame spread rating of 25 or less and a smoke development rating of 50 or less.)
 - PT ports ¼" (2):** NPT brass body with EPDM** check and gasketed cap
- ** EPDM is not suitable for oil service.

MAXIMUM PUMP OPERATING CONDITIONS

- Max. working pressure:** 375 psi (2586 kPa), limited to 175 psi (1207 kPa) when used with Class 125/150 flange adapter
 - Max. working temperature:** 230°F (110°C)*
- *Optional viton for 2½" to 6" sizes elastomers for temperatures up to 300°F (150°C)

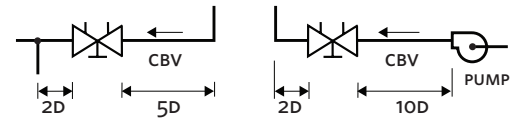
OPERATING PARAMETERS



LEGEND: **A** Body with ANSI 125 ARMgrip flange adapter
B Body alone, or with ANSI 250 ARMgrip flange adapter

INSTALLATION

Generally locate the valve five pipe diameters downstream from a fitting; with two diameters downstream from the balancing valve free from fittings. If a balancing valve is located downstream from a circulation pump, allow a distance of ten (10) diameters between the pump and balancing valves (as illustrated below). To save space, the valve may be used in the angled configuration as an elbow.



ACCESSORIES

PT ports	
PT port extensions	□ 1¾" □ 2¾"
Armstrong flange adapter	ANSI125#, ANSI250# PN16, PN25
Differential pressure manometers	CBDM 200 CBDM 135/60 DPM-15 DPM-100
Flow meters	Orifice plates: 2½" to 12" Venturis: 2½" to 12" butt welded

CIRCUIT BALANCING VALVES

ANSI GROOVED | SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	CONNECTION SIZES	DIMENSIONS INCHES (mm)						WEIGHT lbs (kg)
		A	B (OPEN)	C	D	E	F	
CBV-2½GS	DN65	12.00 (305)	9.62 (244)	2.75 (70)	N/A	1.00 (25)	2.56 (65)	19
CBV-2½GA		7.40 (187)	9.62 (244)	2.75 (70)	4.60 (117)	1.00 (25)	2.56 (65)	(9.0)
CBV-3GS	DN80	12.00 (305)	10.50 (267)	2.44 (62)	N/A	1.00 (25)	3.00 (76)	24
CBV-3GA		8.30 (208)	10.50 (267)	2.44 (62)	3.90 (98)	1.00 (25)	3.00 (76)	(11.0)
CBV-4GS	DN100	14.00 (356)	10.56 (268)	3.00 (76)	N/A	1.25 (32)	3.44 (87)	42
CBV-4GA		9.60 (244)	10.56 (268)	3.00 (76)	4.30 (111)	1.25 (32)	3.44 (87)	(19.0)
CBV-5GS	DN125	17.50 (445)	12.80 (324)	3.60 (92)	N/A	1.25 (32)	4.94 (125)	81
CBV-5GA		12.00 (305)	12.80 (324)	3.60 (92)	5.50 (140)	1.25 (32)	4.94 (125)	(37.0)
CBV-6GS	DN150	20.70 (525)	13.10 (332)	4.40 (113)	N/A	2.00 (51)	5.88 (149)	54
CBV-6GA		14.10 (359)	13.10 (332)	4.40 (113)	6.63 (168)	2.00 (51)	5.88 (149)	(120)
CBV-8GS	DN200	28.19 (716)	24.62 (625)	5.69 (144)	N/A	2.00 (51)	7.88 (200)	310
CBV-8GA		18.93 (481)	24.62 (625)	5.69 (144)	9.19 (233)	2.00 (51)	7.88 (200)	(141)
CBV-10GS	DN250	30.00 (762)	26.50 (673)	6.60 (167)	N/A	2.00 (51)	9.47 (241)	460
CBV-10GA		20.30 (516)	26.50 (673)	6.60 (167)	9.80 (248)	2.00 (51)	9.47 (241)	(209)
CBV-12GS	DN300	38.10 (967)	28.40 (722)	7.60 (194)	N/A	2.00 (51)	12.63 (321)	870
CBV-12GA		24.10 (611)	28.40 (722)	7.60 (194)	14.00 (356)	2.00 (51)	12.63 (321)	(395)

NOTE: All dimensions are in inches (mm) and weights in lbs (kg). Dimensional tolerance up to ±0.125" (3mm).

FLOW RATE RANGES

CONNECTION SIZES	STEM: NO. OF 360° TURNS	KV (OPEN)	CV (OPEN)	MIN. FLOW RATE L/S (USGPM)	MAX. FLOW RATE L/S (USGPM)
DN65	5	60	70	1.9 (30)	4.4 (71)
DN80	5	85	100	3.8 (60)	8.8 (140)
DN100	5	239	280	8.2 (130)	17.0 (270)
DN125	5	281	330	15.8 (250)	31.6 (500)
DN150	5	392	460	25.2 (400)	50.5 (800)
DN200	5	1024	1200	50.5 (800)	107.3 (1700)
DN250	5	1877	2200	94.7 (1500)	189.3 (3000)
DN300	5	2815	3300	151.4 (2400)	315.5 (5000)

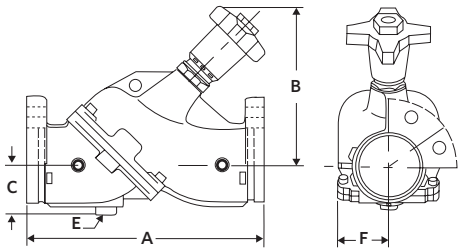
PART NUMBERS

MODEL	PART NUMBER	MODEL	PART NUMBER
CBV-2½GS	570109-386	CBV-6GS	570109-390
CBV-2½GA	570109-486	CBV-6GA	570109-490
CBV-3GS	570109-387	CBV-8GS	570109-391
CBV-3GA	570109-487	CBV-8GA	570109-491
CBV-4GS	570109-388	CBV-10GS	570109-392
CBV-4GA	570109-488	CBV-10GA	570109-492
CBV-5GS	570109-389	CBV-12GS	570109-393
CBV-5GA	570109-489	CBV-12GA	570109-493

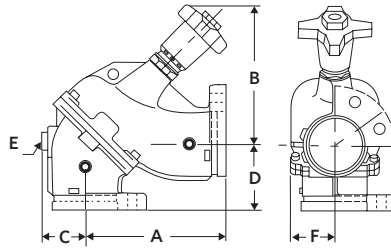
CIRCUIT BALANCING VALVES

ANSI GROOVED | SUBMITTAL

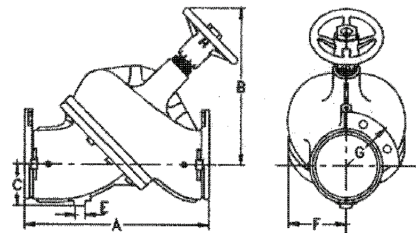
MODEL CBV-GS - 2.5" TO 6"



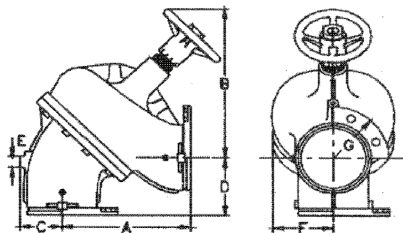
MODEL CBV-GA - 2.5" TO 6"



MODEL CBV-FS - 8" TO 12"

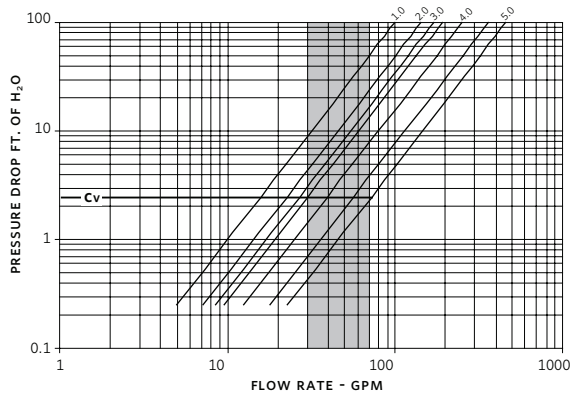


MODEL CBV-FA - 8" TO 12"

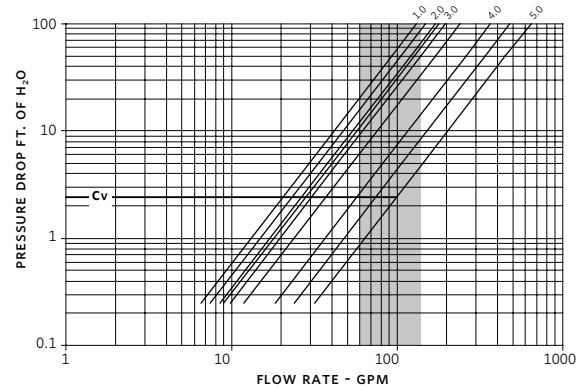


PERFORMANCE CURVES

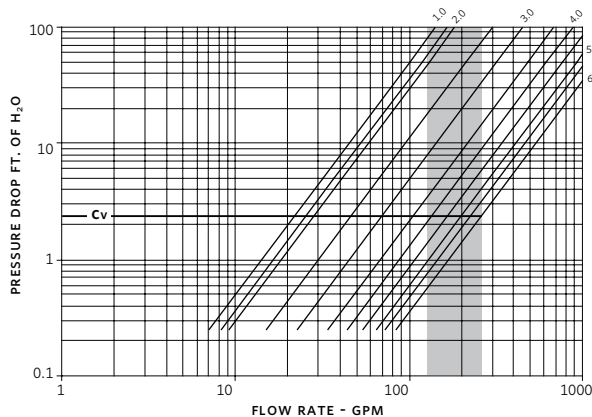
CBV-2½GS/CBV-2½GA



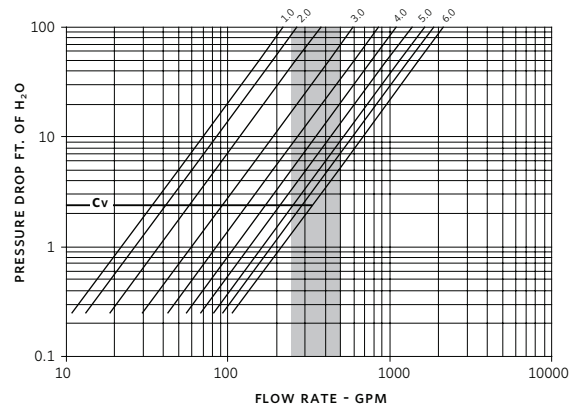
CBV-3GS/CBV-3GA



CBV-4GS/CBV-4GA



CBV-5GS/CBV-5GA

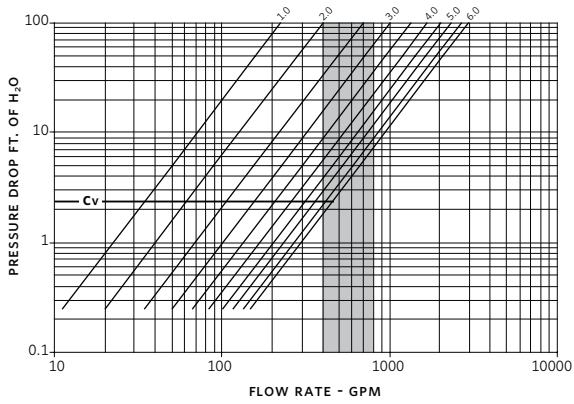


CIRCUIT BALANCING VALVES

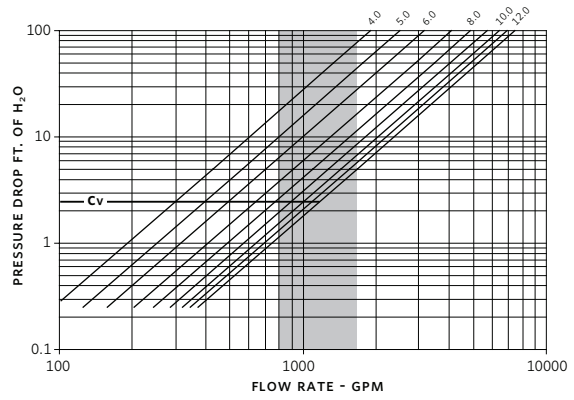
ANSI GROOVED | SUBMITTAL

PERFORMANCE CURVES

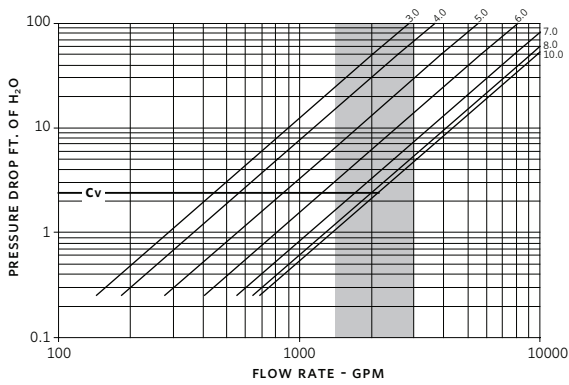
CBV-6GS/CBV-6GA



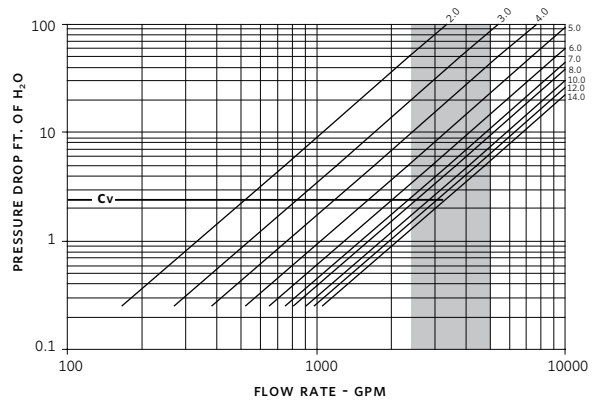
CBV-8GS/CBV-8GA



CBV-10GS/CBV-10GA



CBV-12GS/CBV-12GA



ARMGRIP™ FLANGE ADAPTER KITS

ANSI 125 & 250 | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL	SIZE INCHES (mm)	ANSI RATING		TEMPERATURE RATING		QUANTITY	IDENTIFICATION
FA2.5	2.5 (63.5)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA3	3.0 (76.2)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA4	4.0 (101.6)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA5	5.0 (127.0)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA6	6.0 (152.4)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA8	8.0 (203.2)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA10	10.0 (254.0)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		
FA12	12.0 (304.8)	<input type="checkbox"/> 125	<input type="checkbox"/> 250	<input type="checkbox"/> Standard	<input type="checkbox"/> High Temp		

TECHNICAL DATA

Flange: Ductile iron ASTM A536 GR65-45-12

Connection: Industry standard grooves

Gasket: STANDARD TEMPERATURE: EPDM
 HIGH TEMPERATURE: Viton® or equal

GROOVE SPECIFICATIONS

Armstrong component grooves comply with the following pipe standards for cut groove connections:

- ANSI B36.10
- BS1387 (ISO65)
- DIN2440 & 2448 (ISO4200)
- JIS G3452

Some pipe standards have more than one o.d. per nominal pipe size. Always specify pipe o.d. to match component groove connections.



FLANGE ADAPTER GASKET



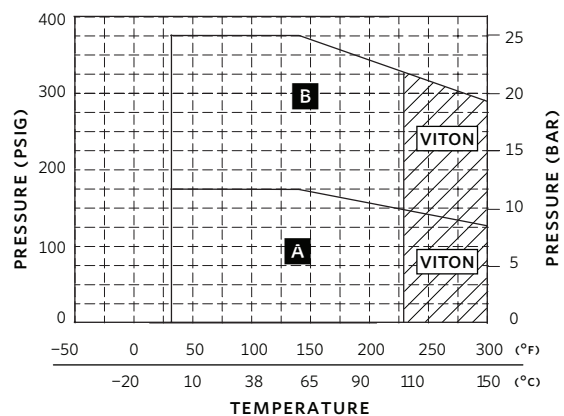
ARMSTRONG DUCTILE IRON FLANGE ADAPTER

APPLICATION

ARMgrip™ Flange Adapter Kits quickly convert industry standard grooved pipe connections to flanged connections, as required to suit application requirements. Armstrong grooved products (such as CBV-G, AFO-G, FTV-G and ssg) include special tabs that engage the flange adapter to prevent rotation during installation, just like a fixed flange. While grooved connection components may provide the greatest initial and installed cost economy, optional ARMgrip™ flange adapters enable the widest range of on-site application versatility, while reducing spare parts costs and inventory.

® Viton is a registered trademark of DuPont Performance Elastomers.

PRESSURE/TEMPERATURE



LEGEND: **A** Body with ANSI 125 ARMgrip flange adapter
B Body alone, or with ANSI 250 ARMgrip flange adapter

ARMGRIP™ FLANGE ADAPTER KITS

ANSI 125 & 250 | SUBMITTAL

ARMGRIP™ FLANGE ADAPTER KITS*

MODEL	PIPE O.D.	FLANGE			BOLT HOLES			WEIGHT lbs (kg)
		RATING	O.D.	THICKNESS	B.C.D	SIZE	NUMBER	
FA2.5	73 (2.9)	ANSI 125**	7.25 (184)	0.88 (22)	5.72/5.50 (146/140)†	0.75 (19)	4 Slots	7 (3)
		ANSI 250	7.50 (190)	1.00 (25)	5.88 (149)	0.88 (22)	8	7 (3)
FA3	89 (3.5)	ANSI 125	7.50 (190)	0.88 (22)	6.00 (152)	0.75 (19)	4	8 (4)
		ANSI 250	8.25 (210)	1.12 (29)	6.62 (168)	0.88 (22)	8	8 (4)
FA4	114 (4.5)	ANSI 125***	9.00 (229)	0.94 (24)	7.50/7.10 (191/180)†	0.75 (19)	8 Slots	9 (4)
		ANSI 250	10.00 (254)	1.25 (32)	7.88 (200)	0.88 (22)	8	20 (9)
FA5	142 (5.6)	ANSI 125***	10.00 (254)	0.94 (24)	8.50 (216)	0.88 (22)	8	11 (5)
		ANSI 250	11.00 (279)	1.38 (35)	9.26 (235)	0.88 (22)	8	22 (10)
FA6	168 (6.6)	ANSI 125	11.00 (279)	1.00 (25)	9.50 (241)	0.88 (22)	8	13 (6)
		ANSI 250	12.50 (318)	1.44 (37)	10.62 (270)	0.88 (22)	12	24 (11)
FA8	219 (8.6)	ANSI 125	13.50 (343)	1.12 (29)	11.74 (298)	0.88 (22)	8	18 (8)
		ANSI 250	15.00 (381)	1.63 (41)	13.0 (330)	1.00 (25)	12	36 (16)
FA10	273 (10.8)	ANSI 125	16.00 (406)	1.19 (30)	14.24 (361)	1.00 (25)	12	24 (11)
		ANSI 250	17.50 (444)	1.88 (48)	15.25 (387)	1.12 (29)	16	51 (23)
FA12	324 (12.8)	ANSI 125	19.00 (483)	1.25 (32)	17.00 (432)	1.00 (25)	12	51 (23)
		ANSI 250	20.50 (521)	2.00 (51)	17.74 (451)	1.25 (32)	16	75 (34)

ARMSTRONG CUT GROOVE CONNECTIONS*

NOMINAL SIZES	PIPE O.D.	O.D. TOLERANCE		GASKET SEAT††	GROOVE WIDTH††	GROOVE DIAMETER		GROOVE DEPTH
		+	-			DIMENSION	TOLERANCE	
2.50 (65)	2.90 (73)	0.01 (0.13)	0.01 (0.13)	0.6 (15.88)	0.3 (7.92)	2.7 (68.83)	±0.005 (0.13)	0.08 (2.11)
3.00 (80)	3.50 (89)	0.01 (0.25)	0.01 (0.25)	0.6 (15.88)	0.3 (7.92)	3.3 (84.68)	±0.010 (0.25)	0.08 (2.11)
4.00 (100)	4.50 (115)	0.01 (0.25)	0.01 (0.25)	0.6 (15.88)	0.4 (9.52)	4.3 (110.1)	±0.010 (0.25)	0.09 (2.3)
5.00 (125)	5.80 (142)	0.01 (0.13)	0.01 (0.13)	0.6 (15.88)	0.4 (9.52)	5.4 (136.8)	±0.005 (0.13)	0.10 (2.41)
6.00 (150)	6.60 (168)	0.01 (0.25)	0.01 (0.25)	0.6 (15.88)	0.4 (9.52)	6.4 (163.7)	±0.010 (0.25)	0.09 (2.29)
8.00 (200)	8.60 (219)	0.03 (0.79)	0.03 (0.79)	0.8 (19.05)	0.4 (11.18)	8.4 (214.4)	-0.64 (0.02)	0.09 (2.34)
10.00 (250)	10.80 (273)	0.06 (1.60)	0.03 (0.79)	0.8 (19.05)	0.5 (12.70)	10.6 (268.3)	-0.69 (0.03)	0.09 (2.39)
12.00 (300)	12.80 (324)	0.09 (2.36)	0.03 (0.79)	0.8 (19.05)	0.5 (12.70)	12.5 (318.3)	-0.76 (0.03)	0.11 (2.78)

PART NUMBERS

MODEL	ANSI		PN		MODEL	ANSI		PN	
	RATING	PART NUMBER	RATING	PART NUMBER		RATING	PART NUMBER	RATING	PART NUMBER
FA2.5	ANSI 125**	570204-000	PN 16	570204-000	FA6	ANSI 125	570212-000	PN 16	570212-000
	ANSI 250	570205-000	PN 25	570204-000		ANSI 250	570213-000	PN 25	570213-500
FA3	ANSI 125	570206-000	PN 16	570206-500	FA8	ANSI 125	570214-000	PN 16	570214-500
	ANSI 250	570207-000	PN 25	570206-500		ANSI 250	570215-000	PN 25	570229-500
FA4	ANSI 125***	570208-000	PN 16	570208-000	FA10	ANSI 125	570228-000	PN 16	570228-500
	ANSI 250	570209-000	PN 25	570209-500		ANSI 250	570229-000	PN 25	570229-500
FA5	ANSI 125***	570210-000	PN 16	570210-500	FA12	ANSI 125	570230-000	PN 16	570230-500
	ANSI 250	570211-000	PN 25	570211-500		ANSI 250	570231-000	PN 25	570231-500

* All dimensions are in inches (mm) and weights in lbs (kg).

** Also fits PN16 and PN25

*** Also fits PN16

† Bolt holes are elongated

†† ±0.03 (±0.76)

PT PORT AND EXTENSIONS | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL NO.	QUANTITY	TAG NO.	COMMENTS

MATERIAL OF CONSTRUCTION

Body and cap: Brass ASTM B-16 H02 C36000

Seal: EPDM

TECHNICAL DATA

Maximum operating pressure: 300 psi (2068 kPa)
 20 bar (PN20)

Operating temperature range: -4°F to 300°F
 (-20°C to 150°C)

DIMENSION DATA - INCHES (MM)

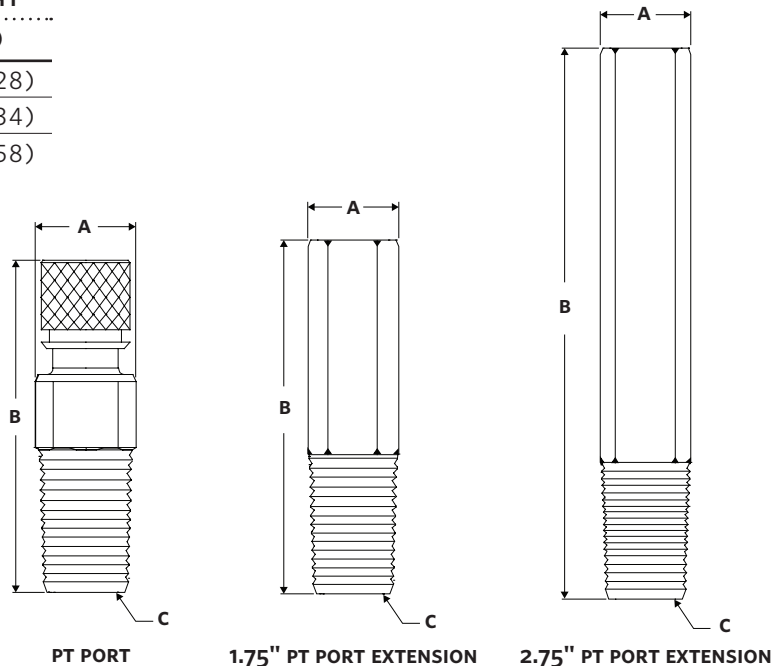
MODEL	DIMENSIONS INCHES (mm)			WEIGHT oz. (g)
	A	B	C	
PT port	0.5 (13)	1.54 (39)	¼" NPT	1.0 (28)
PT port	0.5 (13)	1.75 (44)	¼" NPT	1.2 (34)
extension	0.5 (13)	2.75 (70)	¼" NPT	2.0 (58)

PART NUMBERS

MODEL	ITEM NUMBER
PT port	570148-004
PT port	570148-200
extension	570148-201

PT PORTS & EXTENSIONS

Armstrong PT ports enable the quick connection of pressure and temperature measuring instruments for testing, balancing, and troubleshooting hydronic systems. The dual EPDM seals provide superior protection against leaks in either heated or chilled water systems, and are compatible with water and ethylene or propylene glycol anti-freeze solutions. The ¼" NPT male mounting thread mates with common pipe fittings and the ⅝" flared thread port mates with compatible instrument probes such as those used with an Armstrong DPM differential pressure manometer. Two sizes of ¼" NPT M × F extensions are available to improve the accessibility of PT ports that are mounted in hard-to-reach locations or where pipe insulation is used.



DIFFERENTIAL PRESSURE MANOMETER

SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MODEL NO.	QUANTITY	TAG NO.	COMMENTS

MATERIAL OF CONSTRUCTION

- Service:** Compatible, non-combustible gases & liquids
- Wetted materials:** Type 316L stainless steel
- Accuracy:** ±0.5% of full scale from 60°F - 78°F (15°C - 25°C);
±1% of full scale from 32°F - 60°F and 78°F - 104°F
(0°C - 15°C and 25°C - 40°C)
- Measurement range:** DPM-100: 0 - 100 psi (0 - 689 kPa)
DPM-15: 0 - 15 psi (0 - 103 kPa)
- Maximum pressure:** DPM-100: 200 psi (1379 kPa)
DPM-15: 30 psi (207 kPa)
- Selectable pressure units:** psi, in. H₂O, in. Hg, mm Hg, kPa, bar and mbar
- Operating temperature range:** 32°F TO 200°F (0°C TO 93°C)
- Storage temperature:** -4°F TO 176°F (-20°C TO 80°C)
- Pressure hysteresis:** ±0.1% of full scale
- Connections:** Two 1/8" female NPT
- Adapters:** Two 1/4" male SAE adapters included
- Display:** 0.42" (10.6 MM) 4½ digit LCD with units indicators
- Power source:** 9 V alkaline battery (included)
- Battery life:** Up to 100 hours (less when LCD backlight used)
- Agency approvals:** CE

The Differential Pressure Manometer (DPM) is a rugged, digital instrument used to measure the pressure drop or pressure gain across hydronic system components. The DPM is available in either 0-15 psi or 0-100 psi measurement range models for precise adjustment of circuit balancing valves, and to monitor circulator performance. Both models measure gauge or differential pressure and can store up to 40 readings for later recall. The operator can select from a variety of Imperial and metric measurement units to suit the hydronic system design data. Valuable safety features include visible and audible instrument over-range warning alarms and backlit display for work in poorly illuminated areas. The lightweight, compact DPM design is easy to use in the tight, overhead spaces commonly encountered when balancing or troubleshooting hydronic systems.

CARRYING CASE, HOSES & FITTINGS

- Case is made of durable resin material
- Includes impact resistant foam packing
- Flexible hoses (one red and one blue) complete with fittings:
 - 1/4" female SAE flare straight fitting (connects to 1/4" SAE adapters on meter)
 - 1/4" female SAE 45° elbow fitting (connects to measuring probes)
- Two pressure measuring probes with adapter fittings
- One Armstrong CBV balancing wheel
- One Armstrong ARMflo venturi-style CBV balancing slide rule

DIFFERENTIAL PRESSURE MANOMETER SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	HEIGHT	WIDTH	DEPTH	WEIGHT
DPM-15 meter only	5.88 (150)	2.75 (70)	0.88 (20)	0.90 (0.4)
DPM-15 with case & hose fit	13.50 (343)	17.00 (432)	4.50 (114)	5.85 (2.6)
DPM-100 meter only	5.88 (150)	2.75 (70)	0.88 (20)	0.90 (0.4)
DPM-100 with case & hose fit	13.50 (343)	17.00 (432)	4.50 (114)	5.85 (2.6)

All dimensions are in inches (mm) and weights are in lbs (kg)

PART NUMBERS

MODEL	PART NUMBERS
DPM-15 meter only	570095-201
DPM-15 with case & hose fit	570095-202
DPM-100 meter only	570095-206
DPM-100 with case & hose fit	570095-207
DPM-15 and DPM-100 with case & hose fit	570095-208

PORTABLE FLOW MEASUREMENT METER

CBDM 200 & CBDM 135/60 | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

SPECIFICATION

ITEM	CBDM 200	CBDM* 135/60
Range	0-200	0-135" 0-60"
Diameter	2½"	4½"
Hose length	5"	5"
Adapters	Schrader to ¼" PMP	Schrader to ¼" PMP
Max. operating pressure	500 psi	300 psi
Max. operating temperature	150°F (66 °C)	150°F (66 °C)
Accuracy	±5% ascending	0-135": ±5% ascending 0-200": ±5% ascending

* Two meters in one case

MATERIAL OF CONSTRUCTION

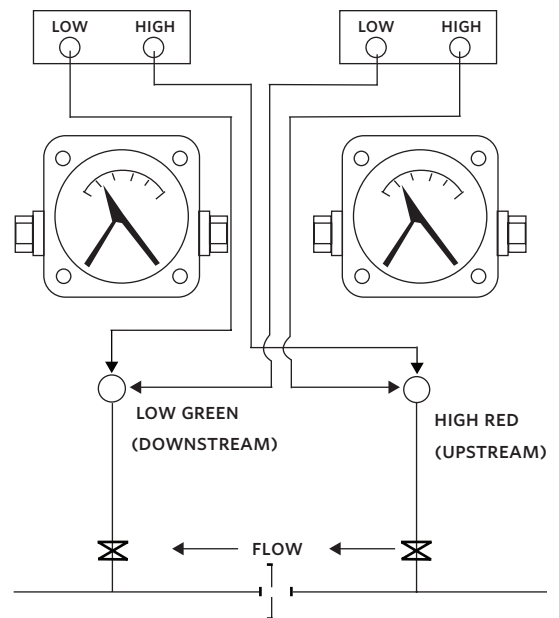
ITEM	CBDM 200	CBDM* 135/60
Gauge	Aluminum body, s.s.316 internals, BUNA-N seals	One polysulfone body and one aluminum body, both with s.s. internals and with BUNA-N seals
Tubing	Nylon	
Fittings	Brass	
Filters	90 micron	
Hoses	BUNA-N with neoprene jacket and 'Schrader' ¼" brass couplet. (Connects with ¼" 37° flare male fitting).	

DIMENSION DATA - INCHES

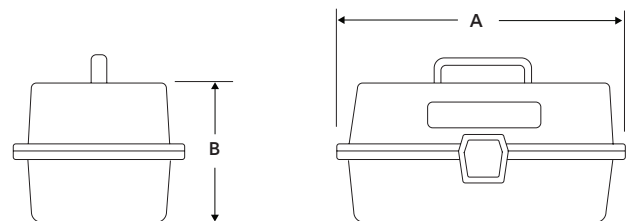
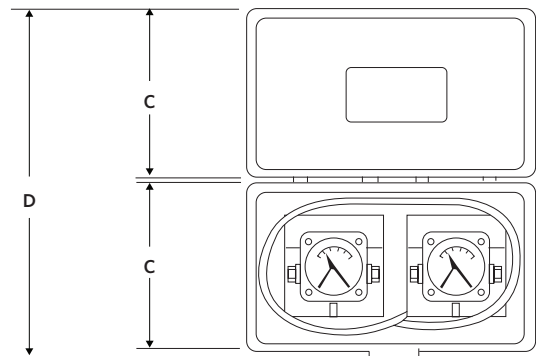
MODEL	A	B	C	D
CBDM 200	12.50	6.00	7.00	14.00
CBDM 135/60	16.50	7.25	9.00	18.50

PART NUMBERS

MODEL	ITEM NUMBER
CBDM 200	570095-003
CBDM 135/60	570095-001



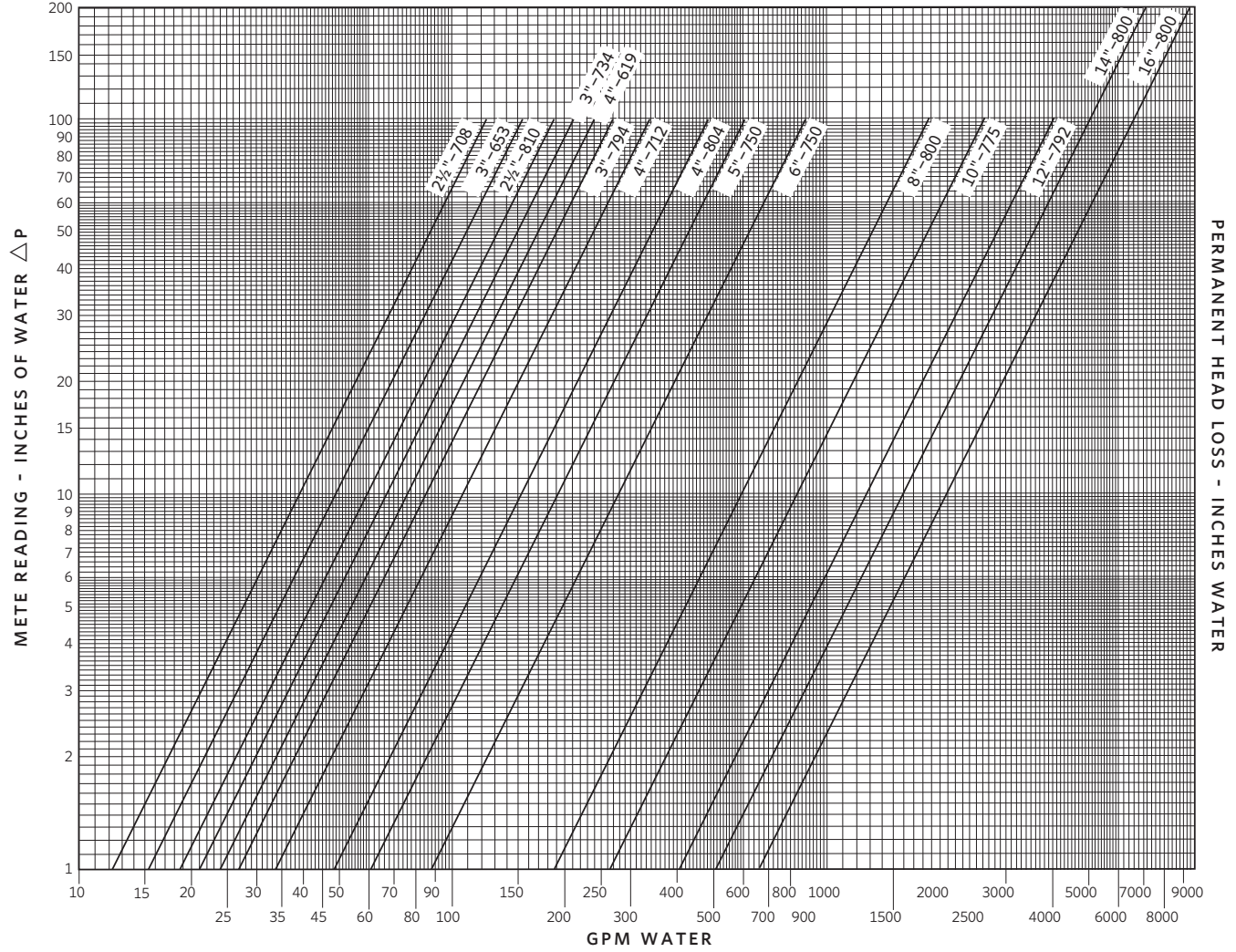
PRESSURE GAUGE CONNECTIONS CBDM 135/60



ARMSTRONG CBV CIRCUIT BALANCING VALVE

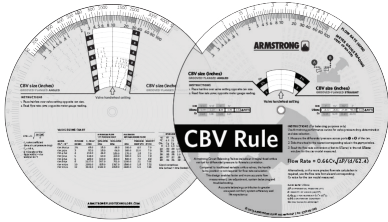
ORIFICE INDICATORS | SUBMITTAL

PERFORMANCE CURVES



CBV BALANCING WHEEL

CBV FLOW MEASUREMENT | SUBMITTAL



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

1/2"-2" CIRCUIT BALANCING VALVES

- 1 Measure the differential pressure (ΔP) across ports A & B (FIG. 1) of the ARMflo CBV.
- 2 Using the CBV Rule, turn the wheel of the slide rule (FIG. 2) until the measured pressure drop appears in window. For example, for the slide rule shown in FIG. 2, the wheel is turned reveal 3.00 in the window.
- 3 Read the flow for the particular size of valve installed. In this case, the reading for a 3/4" valve would be 5.96 USGpm.
- 4 The flow calculation for other valve sizes appear on either side of the center rivet.

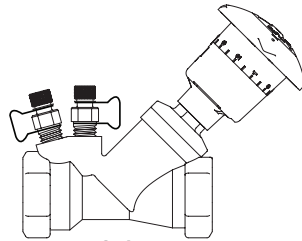


FIG. 1

- 5 In the event that the calculated flow is not within the desired range, turning the handle clockwise will decrease the flow and turning the handle anticlockwise will increase the flow.

Alternatively, or if a more precise flow rate calculation is required, use the flow rate formula and corresponding Cv value for the cbv model measured.

$$\text{Flow rate} = 0.66 \text{ Cv} \sqrt{\Delta P / (d / 62.4)}$$

Flow rate : USgpm

ΔP : Differential pressure (ft of h_2O)

D: Density of liquid (lb/ft³)

D/62.4: 1 for water at 60°F (16°C)

0.66: Conversion constant

Cv: cbv flow co-efficient

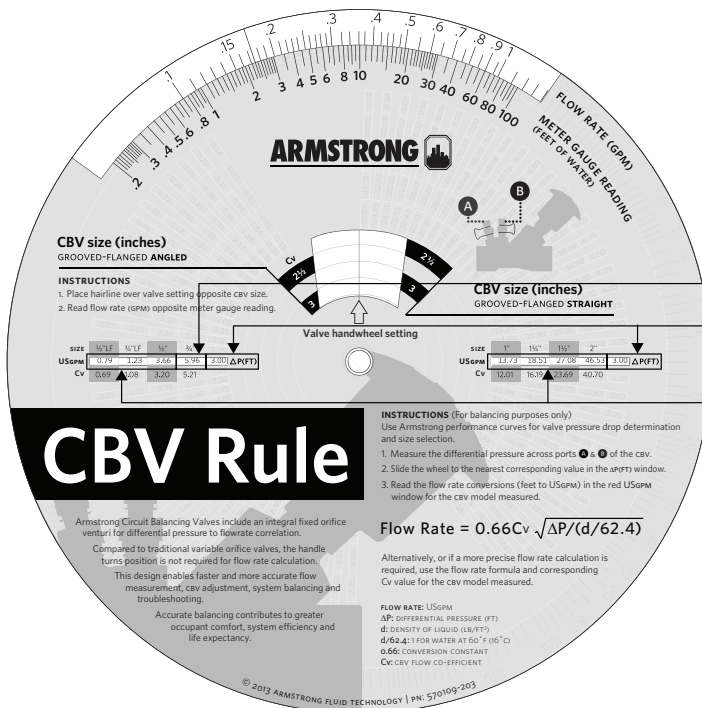


FIG. 2

ARMflo Circuit Balancing Valves (cbv) include an integral venturi for differential pressure to flow rate correlation.

Compared to traditional variable orifice valves, the handle turns position is not required for flow rate calculation.

The venturi design also results in higher flow measurement accuracy (especially when throttled), correctly indicates valve plugging conditions, and enables faster and more accurate flow measurement, CBV adjustment, system balancing and troubleshooting. Accurate balancing contributes to greater occupant comfort, system efficiency and life expectancy.

Flow Rate for 3/4" CBV = 5.96 USGpm
 $\Delta P = 3.0$ ft

Flow Rate for other sizes between 1/2" and 2" sizes

CBV BALANCING WHEEL

CBV FLOW MEASUREMENT | SUBMITTAL

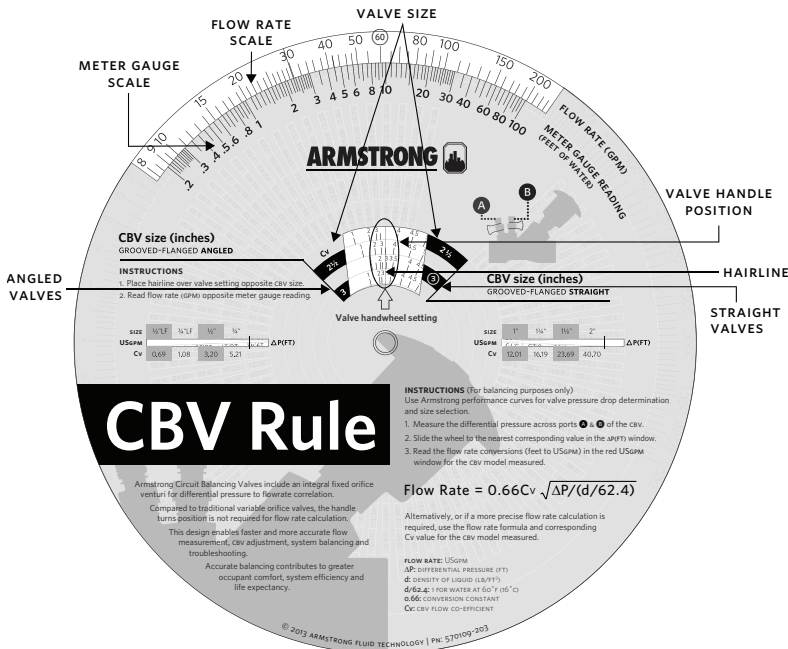


FIG. 3

2½" & 3" CIRCUIT BALANCING VALVES (FIG. 3)

- 1 Measure the differential pressure (ΔP) in the pipe with an appropriate measuring device.
- 2 Determine whether straight or angled configuration is used.
- 3 Set the hairline over the valve handwheel setting of the size and configuration of the valve.
- 4 In this case we have a ③" straight valve with a handwheel setting of "3". The **Meter Gauge Reading** is 10 ft.
- 5 Read across from 10 on the lower scale to reveal a **Flow rate** of ② USgpm.
- 6 In the event that the calculated flow is not within the desired range, turning the handle clockwise will decrease the flow and turning the handle anticlockwise will increase the flow.

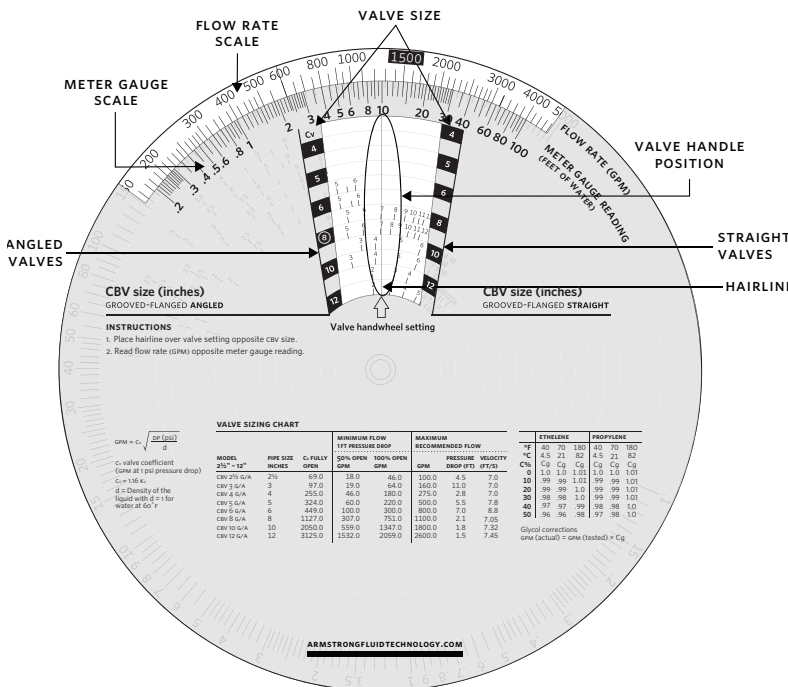


FIG. 4

4"-12" CIRCUIT BALANCING VALVES (FIG. 4)

- 1 The process is the same as with the 2½ & 3" valves. Measure the differential pressure (ΔP) in the pipe with an appropriate measuring device.
- 2 Determine whether straight or angled configuration is used.
- 3 Set the hairline over the valve handwheel setting of the size and configuration of the valve.
- 4 In this case we have a ⑧" angled valve with a handwheel setting of "7". The **Meter Gauge Reading** is 15 ft.
- 5 Read across from 15 on the lower scale to reveal a **Flow rate** of 1550 USgpm.
- 6 In the event that the calculated flow is not within the desired range, turning the handle clockwise will decrease the flow and turning the handle anticlockwise will increase the flow.

S&H CIRCULATOR LESS VOLUTE

KIT | SUBMITTAL



Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIALS OF CONSTRUCTION

Pump body: Gold painted steel, radially split for servicing ease

Motor: Maintenance-free, permanently lubricated

Sealed bearing assembly: Armstrong sba with universal bearing module

- Stainless steel face plate
- Alloy steel shaft (heat treated for long life)
- Copper sleeve
- Circular oil wick

Coupler: 4-spring or flexible coupler

Shaft: Alloy steel (heat treated for long life), copper sleeve

Mechanical seal: Carbon/SiC, stainless steel trim, Viton seal

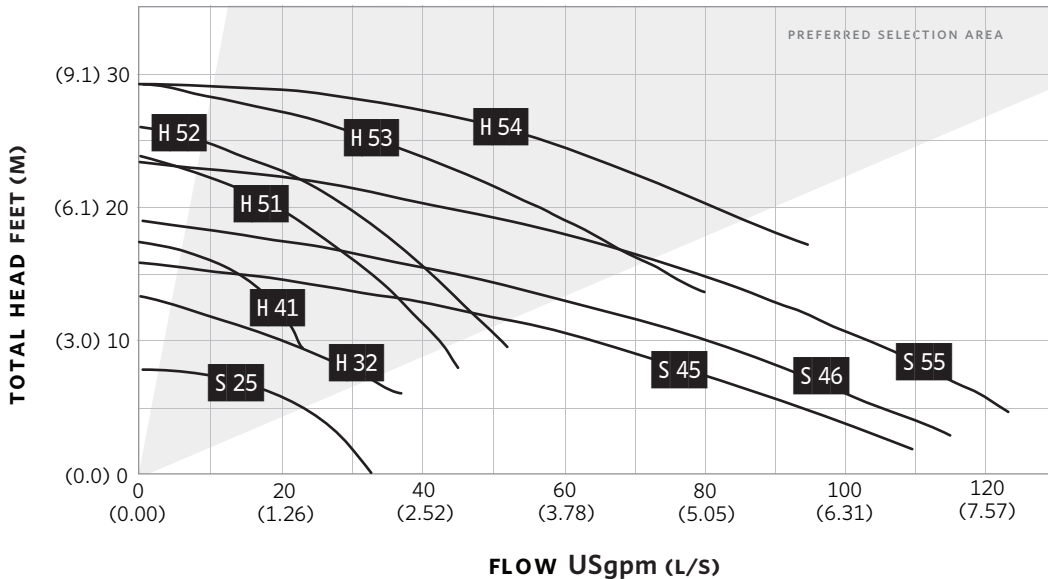
Impeller: Noryl (registered trade mark of GE plastics)

Armstrong in-line circulators are favoured by system designers and chiller/boiler manufacturers who prefer 3-piece construction for reliability, efficiency, and serviceability. Today's models are direct substitutes for all compatible circulators built over the last 50 years. Armstrong Gold Series - Pump Less Volute kits enable you to upgrade and renew circulators manufactured by others, to gain the benefits of Armstrong quality, service, and performance, along with these design innovations.

MAXIMUM PUMP OPERATING CONDITIONS

125 psig at 225°F (863 kPa at 107°C)

PERFORMANCE CURVE



S&H CIRCULATOR LESS VOLUTE

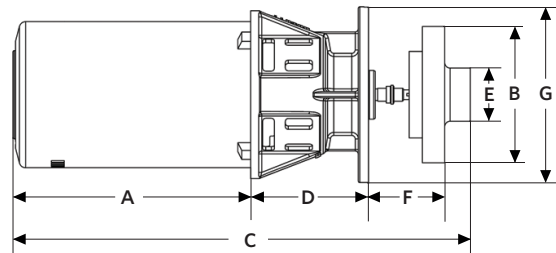
KIT | SUBMITTAL

DIMENSION DATA - INCHES (MM)

MODEL	MOTOR*		DIMENSIONS INCHES (mm)						
	HP	PHASE AND VOLT	A	B	C	D	E	F	G
S25 LV	1/12	1 PHASE 115 V	6.12(155)	2.75(70)	12.62(321)	3.88(98)	1.25(31)	1.25(33)	3.38(86)
H32 LV	1/6		7.50(190)	3.38(86)	13.88(354)	3.38(84)	1.38(36)	1.75(44)	4.25(107)
H41 LV	1/6		7.50(190)	4.25(108)	14.12(358)	3.38(84)	1.25(32)	1.75(44)	5.38(135)
S45 LV	1/4		7.50(190)	4.25(108)	14.25(360)	3.38(84)	2.00(50)	1.75(45)	5.38(135)
S46 LV	1/3		7.50(190)	5.25(135)	14.25(360)	3.38(84)	2.00(50)	1.75(45)	5.38(135)
H51 LV	1/4		7.50(190)	5.25(135)	15.62(396)	4.62(117)	2.12(53)	1.75(43)	6.88(173)
H52 LV	1/3		7.50(190)	5.25(135)	15.62(396)	4.62(117)	2.12(53)	1.75(43)	6.88(173)
H53 LV	1/2	1 PHASE 115/230 V or 3 PHASE 208- 230/460 V	5.12(130)	5.25(135)	13.12(333)	4.62(117)	2.12(53)	1.75(43)	6.88(173)
H54 LV	3/4		10.38(235)	5.25(135)	17.75(452)	4.62(117)	2.12(53)	2.12(54)	6.88(173)
S55 LV	1/2		8.25(210)	5.25(135)	16.75(426)	4.62(117)	2.12(53)	2.12(54)	6.88(173)
Raypak 1**	1/3	1 PHASE 115 V	7.50(190)	4.38(112)	14.75(375)	4.62(117)	2.12(53)	2.12(54)	6.88(173)
Raypak 2**	1/2	1 PHASE 115/208- 230 V	9.88(251)	4.50(115)	17.25(439)	4.62(117)	2.12(53)	2.12(54)	6.88(173)
Raypak 3**	3/4		10.38(235)	4.50(115)	17.75(452)	4.62(117)	2.12(53)	2.12(54)	6.88(173)
Raypak 4**	1/2		9.25(235)	N/A	N/A	4.62(117)	N/A	N/A	N/A

PART NUMBERS

MODEL	PART NUMBER
S25 LV	110116-200
H32 LV	110116-201
H41 LV	110116-202
S45 LV	110116-203
S46 LV	110116-204
H51 LV	110116-300
H52 LV	110116-301
H53 LV	110116-302
H53-3 LV	110116-303
H54 LV	110116-304
H54-3 LV	110116-305
S55 LV	110116-306
S55-3 LV	110116-307
Raypak 1	110108-675
Raypak 2	110108-677
Raypak 3	110108-717
Raypak 4	110108-680



Dimensions shown are for reference only.

*All single phase motors are equipped with built-in thermal overload protection. Three phase motors require external overload protection.

** Base circulator: 2B 1050 AB- LV

COMPANION FLANGES

PARTS INFORMATION

CAST IRON FLANGES APPLICATION GUIDE

CAST IRON MODEL	PIPE SIZE AND PART NUMBER (FOR SINGLE FLANGES/FLANGE KITS)							HARDWARE KIT #	B & G FASTENER KIT #
	0.75"	1.0"	1.25"	1.5"	2.0"	2.5"	3.0"		
Astro 230/ 250CI/CI-R/ 280/210/286/ Compass	116013-011	116012-011	116011-011	116009-011				810120-202	P15696
E7/E8/E9/ E12/E12-TE/ E14/E14-TE/ E15/ E17	116013-011	116012-011	116011-011	116009-011				810120-244	P64910
E10/E11/E13/ E19/E21/E22/ E23/E24/ Astro 290		106073-011	104300-011	104301-011				810120-204	P64940
E16					106074-011			810120-206	F91600
E28/E29							105188-011	810120-208	P65129
E30 (2")/ E33 (2")					106074-011			810120-212	N/A
E30 (3")/ E33 (3")							105188-011	810120-208	P65129
H-32 BF		106073-011	104300-011	104301-011				810120-218	P64930
H-41 BF		116012-011						810120-210	P64230
H-51 BF		116012-011						810120-218	N/A
H-52 BF			116011-011					810120-218	P64910
H-53 BF				N/A				810120-218	P64930
H-54 BF					106074-011			810120-212	N/A
H-63 BF / H-64 BF / H-65 BF				104301-011				810120-204	N/A
H-66 BF / H-67 BF / H-68 BF					106074-011			810120-212	N/A
S-25 BF	116013-011	116012-011	116011-011	116009-011				810120-202	P15696
S-35 BF					105210-011			810120-206	F91600
S-45 BF						105189-011	105188-011	810120-208	P65129
S-46 BF/ S-55 BF/ S-57 BF							105188-011	810120-208	P65129
S-69 BF							133615-010	810120-214	P09540

(A hardware kit is included in each flange kit.)

COMPANION FLANGES

PARTS INFORMATION

LEAD FREE BRONZE FLANGES APPLICATION GUIDE

BRONZE MODEL	PIPE SIZE AND PART NUMBER (FOR SINGLE FLANGES/FLANGE KITS)							HARDWARE KIT #	B & G FASTERNER KIT #
	0.75"	1.0"	1.25"	1.5"	2.0"	2.5"	3.0"		
Astro 230SS/250SS/ 210/280/286/ Compass	116013-041	116012-041	116011-041	116009-041				810120-202	P15696
E7B/E8B/E9B/ E12B/E14B/ E12B-TE/E14B- TE/E15B/E17B	116013-041	116012-041	116011-041	116009-041				810120-244	P64910
E10B/E11B/ E13B/E19B/ E21B/E22B/ E23B/E24B/ Astro 290		106073-041	104300-041	104301-041				810120-204	P64940
E16B					106074-041			810120-206	F91600
E28B/E29B							105188-041	810120-208	P65129
E30B (2")/ E33B (2")					106074-041			810120-212	N/A
E30B (3")/ E33B (3")							105188-041	810120-208	P65129
H-32 AB		106073-041	104300-041	104301-041				810120-218	P64930
H-41 AB		116012-041						810120-210	P64230
H-51 AB		116012-041						810120-218	N/A
H-52 AB			116011-041					810120-218	P64910
H-53 AB				N/A				810120-218	P64930
H-54 AB					106074-041			810120-212	N/A
H-63 AB/ H-64 AB/ H-65 AB				104301-041				810120-204	N/A
H-66 AB/ H-67 AB/ H-68 AB					106074-041			810120-212	N/A
S-25 AB	116013-041	116012-041	116011-041	116009-041				810120-202	P15696
S-35 AB					105210-041			810120-206	F91600
S-45 AB						105189-041	105188-041	810120-208	P65129
S-46 AB / S-55 AB / S-57 AB							105188-041	810120-208	P65129
S-69 AB							106466-041	810120-214	P09540

(A hardware kit is included in each flange kit.)

COMPANION FLANGES

PARTS INFORMATION



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

INDIVIDUAL FLANGE DIMENSIONS

ARMSTRONG		BELL & GOSSETT		DIMENSION inches (mm)				DIAGRAM
CAST IRON	BRONZE	CAST IRON	BRONZE	A	B	C	D	
PART NUMBER	PART NUMBER							
104300-011	104300-041	P03300	P06660	1.25 (32)	3.44 (87)	4.75 (121)	0.50 (13)	1
104301-011	104301-041	P03410	P06690	1.50 (38)	3.44 (87)	4.75 (121)	0.50 (13)	1
105188-011	105188-041	F74000	F74800	3.00 (76)	5.06 (128)	6.00 (152)	0.56 (14)	2
105189-011	105189-041	P03560	P06750	2.50 (63)	5.06 (128)	6.00 (152)	0.56 (14)	2
105210-011	105210-041	—	—	2.00 (51)	3.75 (95)	4.88 (124)	0.56 (14)	2
106073-011	106073-041	P01500	P06620	1.00 (25)	3.44 (87)	4.75 (121)	0.50 (13)	1
106074-011	106074-041	—	—	2.00 (51)	3.16 (80)	5.13 (130)	0.63 (16)	2
116009-011	116009-041	P03430	P03450	1.50 (38)	3.16 (80)	4.25 (108)	0.50 (13)	1
116011-011	116011-041	P03250	P06640	1.25 (32)	3.16 (80)	4.25 (108)	0.50 (13)	1
116012-011	116012-041	P01510	—	1.00 (25)	3.16 (80)	4.25 (108)	0.50 (13)	1
116013-011	116013-041	P00740	—	0.75 (19)	3.16 (80)	4.25 (108)	0.50 (13)	1
133615-010	106466-041	A24600	—	3.00 (76)	6.00 (152)	7.50 (190)	0.75 (19)	2

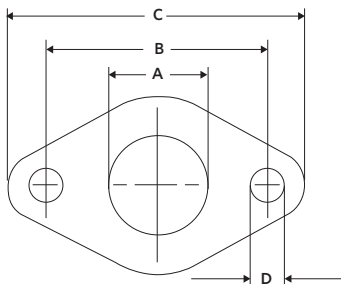


DIAGRAM 1

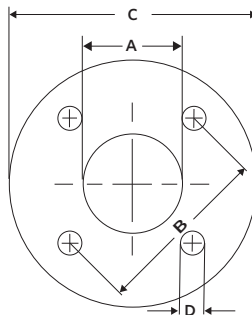


DIAGRAM 2

FLANGES KITS

CROSS REFERENCE | PARTS INFORMATION



FLANGE HARDWARE KITS

APPLICATION CHARTS | PARTS INFORMATION

HARDWARE KIT (WERE USED) CAST IRON

MODEL			PART NUMBER
S-25 BF	Flange	Hardware kit #	810120-202
		B&G Fastener kit #	P15696
S-35 BF	Flange	Hardware kit #	810120-206
		B&G Fastener kit #	F91600
S-45 BF	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
S-46 BF / S-55 BF / S-57 BF	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
S-69 BF	Flange	Hardware kit #	810120-214
		B&G Fastener kit #	P09540

(A hardware kit is included in each flange kit.)

HARDWARE KIT (APPLICATION CHART) LEAD FREE BRONZE

MODEL			PART NUMBER
Astro 20B / 30B / 50B / 70B	Flange	Hardware kit #	810120-202
		B&G Fastener kit #	P15696
E7B / E8B / E9B / E12B / E14B / E12B-TE / E14B-TE / E15B / E17B	Flange	Hardware kit #	810120-244
		B&G Fastener kit #	P64910
E10B / E11B / E13B / E19B / E21B / E22B / E23B / E24B	Flange	Hardware kit #	810120-204
		B&G Fastener kit #	P64940
E16B	Flange	Hardware kit #	810120-206
		B&G Fastener kit #	F91600
E28B / E29B	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
E30B (2") / E33B (2")	Flange	Hardware kit #	810120-212
		B&G Fastener kit #	N/A
E30B (3") / E33B (3")	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
H-32 AB	Flange	Hardware kit #	810120-218
		B&G Fastener kit #	P64930
H-41 AB	Flange	Hardware kit #	810120-210
		B&G Fastener kit #	P64230
H-51 AB	Flange	Hardware kit #	810120-218
		B&G Fastener kit #	N/A
H-52 AB	Flange	Hardware kit #	810120-218
		B&G Fastener kit #	P64910
H-53 AB	Flange	Hardware kit #	810120-218
		B&G Fastener kit #	P64930

Continued on next page...

FLANGE HARDWARE KITS

APPLICATION CHARTS | PARTS INFORMATION

HARDWARE KIT (APPLICATION CHART) LEAD FREE BRONZE

MODEL			PART NUMBER
H-54 AB	Flange	Hardware kit #	810120-212
		B&G Fastener kit #	N/A
H-63 AB / H-64 AB / H-65 AB	Flange	Hardware kit #	810120-204
		B&G Fastener kit #	N/A
H-66 AB / H-67 AB / H-68 AB	Flange	Hardware kit #	810120-212
		B&G Fastener kit #	N/A
S-25 AB	Flange	Hardware kit #	810120-202
		B&G Fastener kit #	P15696
S-35 AB	Flange	Hardware kit #	810120-206
		B&G Fastener kit #	F91600
S-45 AB	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
S-46 AB / S-55 AB / S-57 AB	Flange	Hardware kit #	810120-208
		B&G Fastener kit #	P65129
S-69 AB	Flange	Hardware kit #	810120-214
		B&G Fastener kit #	

(A hardware kit is included in each flange kit.)

FLANGE HARDWARE KITS

CROSS REFERENCE | PARTS INFORMATION

810120-202 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
116653-000	Gasket flange	2	S-25, Astro 20, Astro 30, Astro 50
911123-112	hhcs 7/16 - 14 x 1.5" lcs	4	
913523-100	hh jam nut 7/16 - 14 lcs	4	



810120-204 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
104034-000	Gasket flange	2	H-63, H-64, H-65 E10, E11, E13
911123-114	hhcs 7/16 - 14 x 1.75" lcs	4	
913523-100	hh jam nut 7/16 - 14 lcs	4	

810120-206 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105209-002	Gasket flange	2	S-35 E16, E30, E33
911125-118	hhcs 1/2 - 13 x 2.25" lcs	8	
913125-100	hh nut 1/2 - 13 lcs	8	

810120-208 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105201-000	Gasket flange	2	S-45, S-46 S-55, S-57
911125-120	hhcs 1/2 - 13 x 2.5" lcs	8	
913125-100	hh nut 1/2 - 13 lcs	8	

810120-210 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105176-000	Gasket flange	2	H-41
911123-114	hhcs 7/16 - 14 x 1.75" lcs	4	
913523-100	hh jam nut 7/16 - 14 lcs	4	

FLANGE HARDWARE KITS

CROSS REFERENCE | PARTS INFORMATION

810120-212 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
116117-000	Gasket flange	2	H-54, H-66, H-67, H-68, 4360-2B, 1050-2B
911125-118	hhcs ½ – 13 × 2.25" lcs	8	
913125-100	hh nut ½ – 13 lcs	8	

810120-214 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105201-000	Gasket flange	2	S-69
911129-120	hhcs ⅝ – 11 × 2.5" lcs	8	
913129-100	hh nut ⅝ – 11 unc	8	

810120-216 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
426410-008	Gasket flange	2	1060-3D
911129-120	hhcs ⅝ – 11 × 2.5" lcs	8	
913129-100	hh nut ⅝ – 11 unc	8	

810120-218 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105176-001	Gasket flange	2	H-32, H-51, H-52, H-53 E7, E8, E9, E12, E14 4360-1.25B, 4360-1.5B, 4360-2B
911123-114	hhcs ⅞ – 14 × 1.75" lcs	4	
913523-100	hh jam nut ⅞ – 14 lcs	4	

810120-244 HARDWARE KIT (B&G FASTENER KITS P15696)

PART NUMBER	DESCRIPTION	QUANTITY	PUMP MODEL
105176-000	Gasket flange	2	E7, E8, E9, E12, E14
911123-112	hhcs ⅞ – 14 × 1.5" lcs	4	
913523-100	hh jam nut ⅞ – 14 lcs	4	

FLEX FLANGE | SUBMITTAL



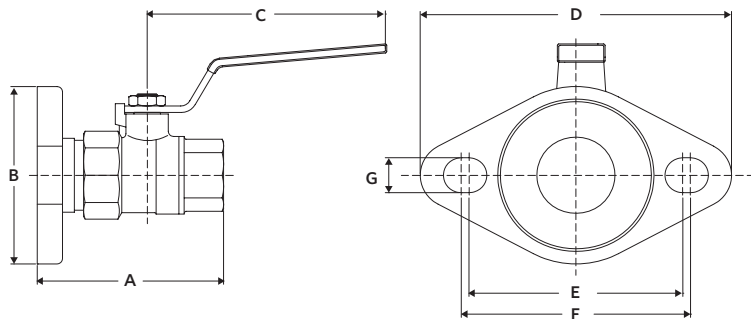
Job: _____
 Representative: _____
 Engineer: _____
 Contractor: _____
 Order no: _____ Date: _____
 Submitted by: _____ Date: _____
 Approved by: _____ Date: _____

MATERIAL OF CONSTRUCTION

- Valve and stem:** Brass
- Flange:** Cast iron/Chromate
- Ball:** Chrome plated brass
- Stem o-rings:** BUNA N
- Seat:** PTFE

MAXIMUM PUMP OPERATING CONDITIONS

150 psig at 250°F (1034 kPa at 121°C)



The Flex Flange is for industry professionals who need a fast and convenient solution for pump installation and isolation.

The Flex Flange provides value by helping plumbing installers:

- Perform quick upgrades and repairs
- Reduce downtime
- Increase client operating efficiency
- Reduce the overall hydronic system cost

The Flex Flange includes an optimized integral check valve to reduce fluid pressure drop, flow restriction and pump capacity loss.

This feature prevents gravity circulation and reverse system flow.

DIMENSION DATA - INCHES (MM)

SIZE	TYPE	A		B	C	D	E	F	G
		ISO (WITHOUT CHECK)	ISO (WITH CHECK)						
½" (DN15)	NPT	2.56 (65)	2.77 (70)	2.70 (69)	3.54 (90)	4.63 (118)	3.18 (81)	3.41 (87)	0.53 (13)
¾" (DN20)	NPT	2.94 (75)	3.43 (87)						
1" (DN25)	NPT	3.50 (89)	4.17 (106)	2.70 (69)	4.53 (115)	4.63 (118)	3.18 (81)	3.41 (87)	0.53 (13)
1¼" (DN32)	NPT	4.03 (102)	4.94 (126)						
1½" (DN40)	NPT	4.31 (110)	5.24 (133)	2.70 (69)	5.51 (140)	4.63 (118)	3.18 (81)	3.41 (87)	0.53 (13)
½" (DN15)	Sweat	2.45 (62)	2.67 (68)						
¾" (DN20)	Sweat	3.04 (77)	3.54 (90)	2.70 (69)	4.53 (115)	4.63 (118)	3.18 (81)	3.41 (87)	0.53 (13)
1" (DN25)	Sweat	3.69 (94)	4.38 (111)						
1¼" (DN32)	Sweat	4.16 (106)	5.07 (129)	2.70 (69)	5.51 (140)	4.63 (118)	3.18 (81)	3.41 (87)	0.53 (13)
1½" (DN40)	Sweat	4.56 (116)	5.49 (139)						

All dimensions are in inches (mm)

FLEX FLANGE | SUBMITTAL

APPLICATION CHART

CIRCULATOR		THE ARMSTRONG FLEX FLANGE KITS									
SERIES	MODELS	FF-050T / FF-050S		FF-075T / FF-075S		FF-100T / FF-100S		FF-125T / FF-125S		FF-150T / FF-150S	
		½" NPT	½" Sweat	¾" NPT	¾" Sweat	1" NPT	1" Sweat	1¼" NPT	1¼" Sweat	1½" NPT	1½" Sweat
Astro	20F/20BF	•	•	•	•	•	•				
	30/30B, 30-3/30B-3	•	•	•	•	•	•				
	50/50B, 50-3/50B-3	•	•	•	•	•	•				
	70/ 70B	•	•	•	•	•	•				
Astro 2	230SS	•	•	•	•	•	•	•	•	•	•
	250SS	•	•	•	•	•	•	•	•	•	•
E series	E7/E7B	•	•	•	•	•	•	•	•		
	E8/E8B	•	•	•	•	•	•	•	•		
	E9/E9B	•	•	•	•	•	•	•	•	•	•
	E10/E10B					•	•	•	•	•	•
	E11/E11B					•	•	•	•	•	•
	E12/E12B	•	•	•	•	•	•	•	•		
	E13/E13B					•	•	•	•	•	•
	E14/E14B	•	•	•	•	•	•	•	•		
	E15/E15B	•	•	•	•	•	•	•	•		
	E17/E17B	•	•	•	•	•	•	•	•		
	E19/E19B					•	•	•	•	•	•
	E21/E21B					•	•	•	•	•	•
	E22/E22B					•	•	•	•	•	•
	E23/E23B					•	•	•	•	•	•
	E24/E24B					•	•	•	•	•	•
	S & H series	S25	•	•	•	•	•	•			
H32						•	•	•	•	•	•
H41		•	•	•	•	•	•	•	•		
H51						•	•	•	•	•	•
H52						•	•	•	•	•	•
H53						•	•	•	•	•	•
H63						•	•	•	•	•	•
H64						•	•	•	•	•	•
H65					•	•	•	•	•	•	

PART NUMBERS

MODEL	PART NUMBER	MODEL	PART NUMBER
FF-050T	110124-200	FF-050S	110124-250
FF-075T	110124-201	FF-075S	110124-251
FF-100T	110124-202	FF-100S	110124-252
FF-125T	110124-203	FF-125S	110124-253
FF-150T	110124-204	FF-150S	110124-254

FLANGE KITS | PARTS INFORMATION



Job: _____

Representative: _____

Engineer: _____

Contractor: _____

Order no: _____ Date: _____

Submitted by: _____ Date: _____

Approved by: _____ Date: _____

CAST IRON FLANGES KITS

CAST IRON MODEL	PIPE SIZE AND PART NUMBER (FOR SINGLE FLANGES/FLANGE KITS)						
	0.75"	1.0"	1.25"	1.5"	2.0"	2.5"	3.0"
Astro 20 / 30 / 50 / 70	816013-111	816012-111	816011-111	816009-111			
Astro 230/250CI/CI-R	816013-111	816012-111	816011-111	816009-111			
E7 / E8 / E9 / E12 / E12-TE / E14 / E14-TE / E15 / E17	816013-211	816012-211	816011-211	816009-211			
E10 / E11 / E13 / E19 / E21 / E22 / E23 / E24		806073-111	804300-111	804301-111			
E16					806074-111		
E28 / E29							805188-111
E30 (2") / E33 (2")					806074-111		
E30 (3") / E33 (3")							805188-111
H-32 BF		N/A	N/A	N/A			
H-41 BF		N/A					
H-51 BF		816012-211					
H-52 BF			816011-211				
H-53 BF				816009-111			
H-54 BF					806074-111		
H-63 BF / H-64 BF / H-65 BF				804301-111			
H-66 BF / H-67 BF / H-68 BF					806074-111		
S-25 BF	816013-111	816012-111	816011-111	816009-111			
S-35 BF					N/A		
S-45 BF						N/A	N/A
S-46 BF / S-55 BF / S-57 BF							N/A
S-69 BF							N/A

(A hardware kit is included in each flange kit.)

FLANGE KITS | PARTS INFORMATION

LEAD FREE BRONZE FLANGES*

BRONZE MODEL	PIPE SIZE AND PART NUMBER (FOR SINGLE FLANGES/FLANGE KITS)						
	0.75"	1.0"	1.25"	1.5"	2.0"	2.5"	3.0"
Astro 20B / 30B / 50B / 70B	816013-841	816012-841	816011-841	816009-841			
Astro 230SS/250SS/280/286	816013-841	816012-841	816011-841	816009-841			
Astro 290		806073-841	804300-841	804301-841			
E7B / E8B / E9B / E12B / E14B / E12B-TE / E14B-TE / E15B / E17B	816013-941	816012-941	816011-941	816009-941			
E10B / E11B / E13B / E19B / E21B / E22B / E23B / E24B		806073-841	804300-841	804301-841			
E16B					806074-841		
E28B / E29B							805188-841
E30B (2") / E33B (2")					806074-841		
E30B (3") / E33B (3")							805188-841
H-32 AB		N/A	N/A	N/A			
H-41 AB		N/A					
H-51 AB		816012-941					
H-52 AB			816011-941				
H-53 AB				816009-841			
H-54 AB					806074-841		
H-63 AB / H-64 AB / H-65 AB				804301-841			
H-66 AB / H-67 AB / H-68 AB					806074-841		
S-25 AB	816013-841	816012-841	816011-841	816009-841			
S-35 AB					N/A		
S-45 AB						N/A	N/A
S-46 AB / S-55 AB / S-57 AB							N/A
S-69 AB							N/A

(A hardware kit is included in each flange kit.)

* Complies with section 116875 of the California Health and Safety Code & Vermont Act 193 (Lead content of all wetted surfaces 0.25% or less).

FLANGE KITS | PARTS INFORMATION

UNION FITTING SETS (CONTAIN TWO (2) HALF UNIONS AND GASKETS)

MODEL	PART NUMBER	CONNECTION	WEIGHT
Astro 20/25BU	810120-220	1.25" NPSM × 0.5" Sweat	2 (0.91)
	810120-222	1.25" NPSM × 0.75" Sweat	
	810120-224	1.25" NPSM × 0.5" FNPT	
Astro 220SSU/225SSU	810120-320	Lead free bronze* 1.25" NPSM × 0.5" Sweat	
	810120-322	Lead free bronze* 1.25" NPSM × 0.75" Sweat	
	810120-324	Lead free bronze* 1.25" NPSM × 0.5" FNPT	

All dimensions are in inches (mm) and weights are in lbs (kgs).

*Certified <0.25 weighted average percent lead and Complies with California Health and Safety Code Section 116875 (commonly known as AB1953).

SEAL BEARING ASSEMBLIES

WITH SEAL KIT ONLY | PARTS COMPARISON

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
S-35 H-32	2 1, 1¼, 1½	816549-091†	Sleeve design	2 (Manufactured prior to 7/76; Date Code GT)	189165LF/ 189166LF
		816549MF-091	Maintenance free design	HV (Manufactured prior to 4/76; Date Code DT)	N/A
S-35 For B&G Pumps Only	2 1, 1¼, 1½	816023-001†	Sleeve design	2 (Manufactured 7/76 or after; Date Code GT)	189120-29, 189131
		816023MF-001	Maintenance free design	HV (Manufactured 4/76 or after; Date Code DT)	N/A
S-45 S-45 S-46 H-41	2½ 3 3 1	816027-002† 816027MF-002	Sleeve design	2½ LD3	189105LF
			Maintenance free design	HD3 1 PR	N/A
S-55 S-57 H-51 H-52 H-53 H-54	3 3 1 1¼ 1½ 2	816032-000† 816032MF-000	Sleeve design	PD-35 PD-37	186863LF 186864LF
			Maintenance free design	60-1 (Old), 60-11 (New) 60-2 (Old) 60-3 (Old), 60-13 (New) 60-4 (Old), 60-14 (New)	N/A
For B&G Pumps Only	—	816133-000* 816134-000*	BF AB	PD-39 60-5 to 60-10 (Old), 60-15 to 60-21 (New)	185232LF 185232LF 185234LF 185234LF 185260LF 185262LF



* Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following coverplates and are supplied with the seal kit and body gasket.

COVER PLATES FOR B&G PUMPS SBA

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
For B&G Pumps Only	—	816347-011	BF	—	
		816347-041	AB	—	

BEARING ASSEMBLIES WITH SEAL AND NFI IMPELLER

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
S-25	¾, 1, 1¼, 1½	810119-001†	Sleeve Design	75 to 100	118844LF/ 189134LF
		810119MF-001	Maintenance Free Design		N/A
S-35	2	810119-003†	Sleeve	New Style HV	189165LF/ 189166LF
		810119MF-003	Maintenance Free Design		N/A
H-32	1, 1¼, 1½	810119-003†	Sleeve	Any 2" NFI	189165LF/ 189166LF
		810119MF-003	Maintenance Free Design		N/A



BEARING ASSEMBLIES WITH MECHANICAL SEAL KIT & COVER PLATE

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
S-69	3"	816861-011	STD BF	No equivalent	No equivalent
H63-H65	1½"	816861-841	AB		



BEARING ASSEMBLIES WITHOUT SEAL AND COVER PLATE

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
S-69	3	816366-041	STD, BF, AB	PD-39	—
H-63 to H-65	1½			60-5 to 60-7 (Old), 60-15 to 60-17 (New)	
H-66 to H-68	2			60-8 to 60-10 (Old), 60-18 to 60-21 (New)	

The following coverplates are used with Bearing Assemblies 816366-041 and 816366-071 and do not normally require replacement when Armstrong Bearing Assembly is changed or replaced. For a complete Armstrong Seal Bearing Assembly (including coverplate, seal and body gasket), use P/N's 816861-011 BF or 816861-841 AB.

COVER PLATES FOR B&G PUMPS SBA

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
For B&G Pumps Only	—	816346-011	CI	—	—
		816346-841	BR		

† As of 07/01/94, a Stainless Steel faceplate is standard. For all iron applications, please contact the factory.

SEAL BEARING MODULES

& ACCESSORIES | PARTS COMPARISON

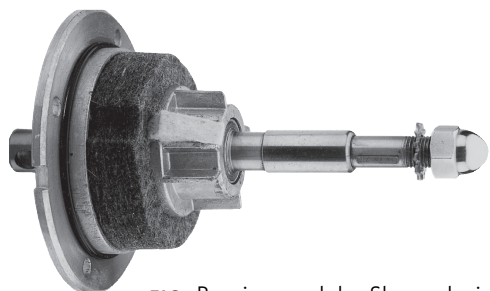


FIG. Bearing module- Sleeve design

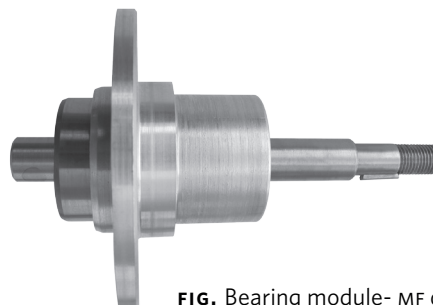


FIG. Bearing module- MF design

SHAFT AND BEARING MODULE

ARMSTRONG				B&G EQUIVALENT	
MODEL	SIZE	PART #	DESCRIPTION	MODEL	PART #
S-25 to S-57, H-32 to H-54	½	816999-041*	Module - Sleeve design	75 to PD37, HV to 60-14	No equivalent
		816999MF-041	Module - MF design		

SHAFT AND SLEEVE ASSEMBLIES*

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION (SLEEVE)	MODEL	OLD PART #	NEW PART #
S-25 to S-57 H-32 to H-54	API only	816997-041	Copper	75 to PD37, HV to 60-14	No equivalent	189035
					No equivalent	
S-69, H-63 to H-68	—	816354-041	Copper	PD39, 60-15 to 60-21	No equivalent No equivalent	—

SHAFT KEYS*

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	OLD PART #	NEW PART #
S-25 to S-57, H-32 to H-54	—	974507-400	#2 Woodruff	75 to PD37, HV to 60-14	P-4138	P04940
S-69, H-63 to H-68	—	974508-100	#3 Woodruff	PD39, 60-15 to 60-21	PW1-3138 HP-606	P51760
		974515-100	#9 Woodruff			H32550

BEARING & CAP ASSEMBLY*

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	OLD PART #	NEW PART #
S-69, H-63 to H-68	—	874112-000	Bearing & Cap Assembly	PD39, 60-15 to 60-21	No equivalent	—

*Only available for sleeve design SBAS.

OILWICKS

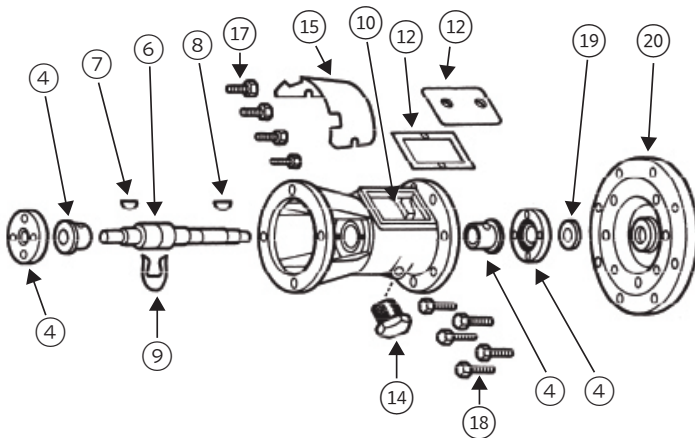
ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	OLD PART #	NEW PART #
S-25 to S-46, H-32, H-41	—	806993-000	Wool	75 to 3HD, HV, 1 PR	P4-4130	118395
S-55, S-57, H-51 to H-54	—	812138-000	Wool	60-1 to 60-40, PD35, PD37	PW4-4130	118624
S-69, H-63 to H-68	—	816565-000	Wool	60-15 to 60-20, PD39	No equivalent	—

ARMSTRONG SERIES 6 SBA

(STANDARD CONSTRUCTION IS BRONZE FITTED)

FOR MODELS

S69, H63-H68, 1060



ITEM NUMBER	PART DESCRIPTION	PART NUMBER
⑩	Bearing bracket	816342-011
④	Bearing cap assembly	874112-000
⑮	Coupler guard	116114-000
⑦	Coupler key (woodruff #9)	974515-100
⑳	Coverplate (steel)	816346-041
⑱	Coverplate capscrews $\frac{5}{16}$ -18 \times $\frac{3}{4}$	911119-106
⑧	Impeller key (woodruff #3)	974508-100
⑭	Oil level window	116904-001
⑨	Oil slinger	116369-000
⑫	Oil well cover assy. c/w gasket	816362-000
⑰	Res. mtd. mtr. Capscrews $\frac{3}{8}$ -16 \times $\frac{5}{8}$ (4 req'd)	911121-106
⑥	Shaft & sleeve assembly	816354-041
⑥	Shaft & sleeve assy. (s/s shaft)	816354-071
⑲	Water slinger	116368-000

REBUILD KIT FOR SERIES 6 SBA

Contains items ④, ⑥, ⑦, ⑧, and ⑨ above plus seal kit, oil, and body gasket.

816366-000

COUPLER ASSEMBLIES

PARTS COMPARISON

COUNTER CLOCKWISE ROTATION				
ARMSTRONG			B&G EQUIVALENT	
MODEL	PART #	DESCRIPTION	MODEL	PART #
S-25, S-34, S-35, H-32, H-41	806026-001†	½ × ½	75 to 150, 1½, 2, HV, PR	118705 189110, 118712
S-45, S-46	806168-001†	½ × ½	2½, LD3, HD3	118723
CLOCKWISE ROTATION				
S-55, S-57	810120-006†† 806137-001* 806140-001	½ × ⅝ ½ × ⅝ ½ × ¾	PD35, PD37	118709 118709 118708
H-51, H-52	810120-003†† 807436-000*	½ × ½ ½ × ½	60-1, 60-2 (Old), 60-11 (New)	118473
H-53, H-54	810120-006†† 806137-000*	½ × ⅝ ½ × ⅝	60-3, 60-4 (Old), 60-13, 60-14 (New)	118709 118709
S-69, H-63 to H-68	810120-008†† 812734-000* 816665-000*	⅝ × ½ ⅝ × ½ ⅝ × ⅝	PD39, 60-5 to 60-10 (Old), 60-15 to 60-21 (New)	186410 186410 118476, P77265



COUPLER/MOUNTING RING KIT

ARMSTRONG			B&G EQUIVALENT	
MODEL	PART #	DESCRIPTION	MODEL	PART #
For B&G Pumps Only	810120-004 810120-005		75 to 150, 2, HV, PR, 1, 1¼, 1½, 2	118706 118707

MOTOR MOUNTING RINGS (RESILIENT MOTORS)

ARMSTRONG				
MODEL	SIZE	PART #	DESCRIPTION	PART #
48 Frame Marathon motors	1/12, 1/6, 1/4, 1/3 hp	810120-050	—	118223 (API P/N 810120-000)
56 Frame 1 Phase & 3 Phase Marathon motors	½-1 hp	874055-000	—	118227 (API P/N 810120-001)
56 Frame marathon	½, ¾ hp	874055-001	—	118228 (API P/N 810120-002)
1 Phase Double capacitor motors only	—	—	—	

*Flexible spacer type coupling.

† 4-Spring type coupler.

†† 4-Spring type coupling. For use on B&G circulators only.

MOTORS | PARTS COMPARISON

MOUNTED MOTORS - 1750 RPM - SINGLE PHASE - 60 CYCLE

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION (VOLTS)	MODEL	OLD PART #	NEW PART #
S-25	1/12 hp	805316-010	115 CCW	70-150	P-115Z-3 P2Z-4	111034
S-35, H-32, H-41 & 1050 1B, 1.25B and 1.5B	1/8 hp	817025-001	115 CCW	1 1/2, 2, HV, PR	P-115Z-4 P4Z-4	111036, 111031
For B&G Only	1/8 hp	817025-005	115 CCW	-	-	111061
S-45	1/4 hp	817025-007	115 CCW	2 1/2, LD3	P-115Z-10 P1Z-10	111040
S-46	1/3 hp	817025-013	115 CCW	HD3	P-115Z-12 P107-6Z-496	111042
H-51	1/4 hp	816141-001	115 CW	60-11	PDH-115Z-10 PWH-314-6Z-1296	169035
H-52	1/3 hp	816141-002	115 CW	60-2	PDH1530Z-12 PWH-937-6Z-1296	169038
H-53, H-63, S-55	1/2 hp	811757-001*†	115/230 CW	60-13, 60-15, PD35	PDH1530Z-14 PWH-929-6Z-1296	111044
H-54, H-64, H-66, S-57, 1050 1.5B & 2B and 1060 1.5D & 2D	3/4 hp	811757-002*†	115/230 CW	60-14, 60-16, 60-18, PD37	PDH1530Z-16 PWH-925-6Z-1296	111047
H-65, H-67, S-69, 1060 1.5D & 2D	1 hp 1 1/2 hp	811757-007† 816678-062**	115/230 CW 115/230 CW	60-17, 60-19, PD39 60 2A	PDH1530Z-18 PD-2635Z-1296	111050 169005



MOTORS | PARTS COMPARISON

MOUNTED MOTORS - 1750 RPM - THREE PHASE - 60 CYCLE

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION (VOLTS)	MODEL	OLD PART #	NEW PART #
H-53, H-63, S-55	½ hp	831011-083** 811757-020*†	208/230/460	60-13, 60-15, PD35	PDH82040Z-14 PWH-931-6Z-1296	111046
H-54, H-64, H-66, S-57	¾ hp	831012-083** 811757-024*†	208/230/460	60-14, 60-16, 60-18, PD37	PDH82040Z-16 P922-6PDZ-1296	111049
H-65, H-67, S-69	1 hp	816676-069** 811757-028	208/230/460	60-17, 60-19, PD39	PDH82040Z-18 PD2628Z-1296	169089 111051 169090
H-68	1½ hp	816678-069**	208/230/460	60-20	PDH82040Z-20 PWH-2641Z-1296	169091 111052 169092
1000	2 hp	816681-069	208/230/460	60-21	—	169094

Notes:

† Resilient Mounted Motors.

* When replacing B&G motors, also replace coupler with Armstrong

806137-000 for the 5 series pumps and 816665-000 or the 6 series pumps.

** Rigid mount ball bearing motor can be supplied in lieu of the Resilient mount motor.

REAR BEARINGS

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	OLD PART #	NEW PART #
S-25 to S-57, H-32 to H-54	—	816001-000*	—	75 to PD37, HV to 60-14	P4Z-4115	118697

SEAL KITS | PARTS COMPARISON



ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	OLD PART #	NEW PART #
S-25 to S-35, S-46						
H-32 to H-41	½"	816706-021	SS with Buna	75 to PD37,	#6 Kit	118681
S-55 to S-57 & H-51 to H-54 & all 1050s	½"	816706-023	SS with Viton	HV to 60-14	No equivalent	186681
For B&G Pumps Only	¾"	810120-009	—	PD38-40, 60A BF or AB		186499
S-69,	¾"	816707-001	Buna	PD39,	No equivalent	—
H-63 to H-68	¾"	816707-003	Viton	60-15 to 60-20	No equivalent	
E (old)	¼"	880200-877				
E.2	7/16"	880202-677	SS with Viton			

IMPELLERS | PARTS COMPARISON

ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	DIA.	PART #
S-25	2¾"	812961-011	ST	100	2¾"	118840
	2¾"	812961-111	NFI		2¾"	189132LF
	2¾"	812961-041	BR		2¾"	118431LF
S-35	3¾"	816322-011	ST	2		118668
	3¾"	816322-041	BR			P07792
	3¾"	816322-111	NFI			189128LF
H-32	3¾"	816322-011	ST	HV		No equivalent
	3¾"	816322-041	BR			
	3¾"	816322-111	NFI			
	3¾"	816556-011	ST	2, HV	3¾"	118668LF
	3¾"	816556-041	BR		3¾"	P07792
	3¾"	816556-111	NFI			N/A
S-45	3⅞"	816305-028	ST	2½, LD-3	3⅞"	118676
	3⅞"	816305-058	BR		3⅞"	118440LF
	3⅞"	816305-328	NFI			
S-46	4¼"	816305-025	ST	HD-3	4¼"	118675
	4¼"	816305-055	BR		4¼"	118439LF
	4¼"	816305-325	NFI			N/A
S-55	4¾"	816304-021	ST	PD35	4¾"	118630
	4¾"	816304-051	BR		4¾"	118627
	4¾"	816304-321	NFI			N/A
S-57	5¼"	816304-017	ST	PD37	5¼"	118630
	5¼"	816304-047	BR		5¼"	118627LF
	5¼"	816304-317	NFI			N/A
S-69	5⅞"	816308-012	ST	PD39		118452
	5⅞"	816308-042	BR			118453LF
H-41	4¼"	816301-025	ST	1 PR	4¼"	118830
	4¼"	816301-055	BR		4¼"	118612LF
	4¼"	816301-325	NFI			N/A
H-51	5"	816302-019	ST	60-11	5¼"	N/A
	5"	816302-049	BR		5¼"	186359 & 18630LF
	5"	816302-319	NFI			N/A
H-52	5¼"	816302-017	ST	60-2	5¼"	N/A
	5¼"	816302-047	BR		5¼"	186359LF
	5¼"	816302-317	NFI			N/A

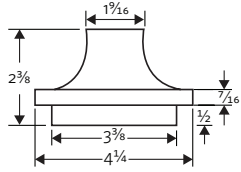


IMPELLERS | PARTS COMPARISON

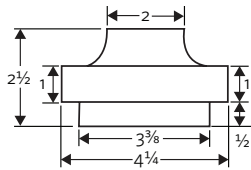
ARMSTRONG				B&G EQUIVALENT		
MODEL	SIZE	PART #	DESCRIPTION	MODEL	DIA.	NEW PART #
H-53	5¼"	816303-017	ST	60-13	5¼"	P61010
	5¼"	816303-047	BR		5¼"	186368
	5¼"	816303-317	NFI			
H-54	5¼"	816304-017	ST	60-14	5¼"	118629
	5¼"	816304-047	BR		5¼"	118626
	5¼"	816304-317	NFI			
H-63	5¾"	174058-021	CI	60-15	5¼"	—
	5¾"	874058-051	BR			
H-64	6½"	174058-015	CI	60-16	—	—
	6½"	874058-045	BR			
H-65	7"	174058-011	CI	60-17	—	—
	7"	174058-041	BR			
H-66	5⅝"	816393-052	BR	60-18	—	—
H-67	6¼"	816393-047	BR	60-19	—	—
	6¼"	816393-017ST				
H-68	6¾"	816393-043	BR	60-20	—	—
	6¾"	816393-013ST				
For B&G Pumps Only	7"	816309-041	BR	60	Various	P57445
	7"	816310-041	BR	1-½A		
	6"	816311-041	BR	60 2A		
				PD-38, 39, 40	Various	118453

IMPELLERS | PARTS COMPARISON

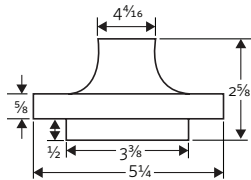
DIMENSIONS



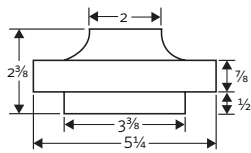
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
H-41	816301-025 Steel	PR	118830
	816301-055 Brass		118612 Brass



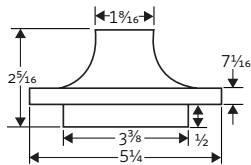
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-46	816305-025 Steel	HD-3	118675 Steel
	816305-055 Brass		118439 Brass



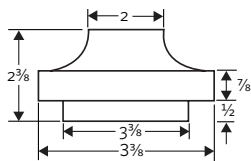
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
H-53	816303-047 Brass	60-13, 1 1/2AA	186368



ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-57	816304-017 Steel	PD 37	118629 Steel
H-54	816304-047 Brass	60-14, 2AA	118626 Brass



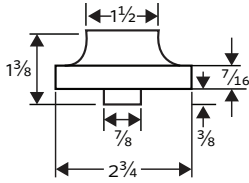
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
H-52	816302-047 Brass	60-11, 1AA, 1 1/4AA	186359



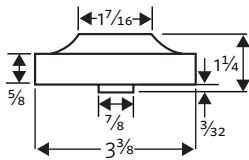
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-55	816304-021 Steel	PD35	118630 Steel
	816304-051 Brass		118627 Brass

IMPELLERS | PARTS COMPARISON

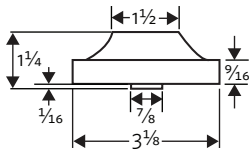
DIMENSIONS



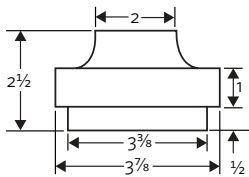
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-25	812961-011 Steel	Series 100	118431 Brass
	812961-841 Brass		118840 (Discontinued)



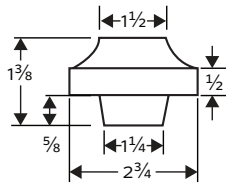
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
	816556-011 Steel	HV & 2" (old stlye)	118668 Steel
	816556-841 Brass		118436 Brass



ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
	806331-111 NFI	1" & 1 1/2" (old stlye)	118665-6 Steel 118434-5 Brass



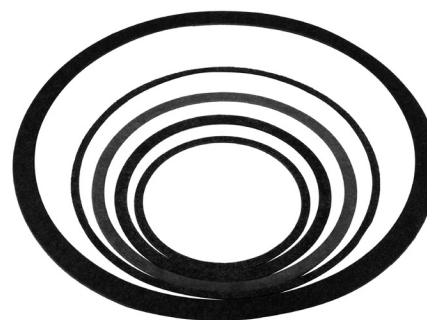
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-45 2 1/2" or 3"	816305-028 Steel	2 1/2" & LD-3	118676 Steel
	816305-058 Brass		118440 Brass



ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-25	812961-111 NFI	Series 100	189132

GASKETS | PARTS COMPARISON

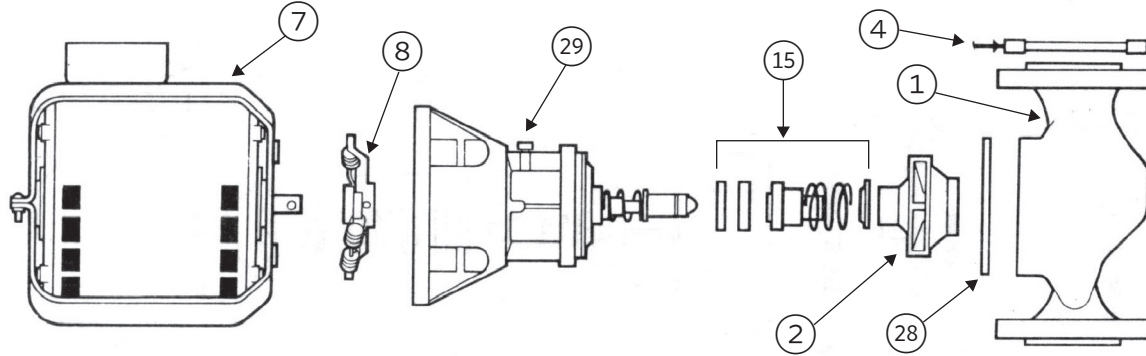
BEARING GASKETS			
ARMSTRONG		B&G EQUIVALENT	
MODEL	PART #	MODEL	PART #
S-25 to S-57, H-51 to H-54	103408-000	75 to PD-37, 60-11 to 60-14	P01830
BODY GASKETS			
S-25	104442-000	75 to 150	P04080
S-35, H-32	106049-000	1½, 2, HV	P04890
S-45, S-46, H-41	106050-000	2½, 3LD, 3HD, 1 PR	P05800
S-55, S-57, H-51 to H-54 & 1050	106158-000	PD35, PD37, 60-11 to 60-14	P57410
S-69, H-63 to H-68 & 1060	106592-000	PD39, 60-15 to 60-21	P57700
FLANGE GASKETS			
S-25	816653-000	75 to 150	118368
(Alternative wide gasket for s-25 after serial 6703)			
H-41, H-51, H-52, H-53	805176-000	1 PR, 60-11, 60-12, 60-13	118368
S-34, H-32	804034-000	1½, HV	118373
S-35	805209-000	2	118065
S-45, S-46, S-55, S-57, S-69	805201-000	2½, LD3, HD3, PD35, PD37, PD39	118129
H-54, H-66 to H-68	816117-000	60-14, 60-18 to 60-21	118378
H-63 to H-65	804034-000	60-15 to 60-17	118373



PUMP BODIES | PARTS COMPARISON

ARMSTRONG			B&G EQUIVALENT	
MODEL	PART #	DESCRIPTION	MODEL	PART #
S-25	805482-011	CI	75 to 150	118339
	105482-841	LF Bronze		118413LF
H-32	816402-011	CI	—	
	116402-841	LF Bronze		
S-35	816327-011	CI	2	
	116327-841	LF Bronze		
S-45	805484-011	CI	2½, LD3, HD3	118644
S-46	105484-841	LF Bronze		P07610
H-41	811240-011	CI	1PR	118637
	111240-841	LF Bronze		P07570
S-55	804133-011	CI	PD35, PD37	118449
S-57	104133-841	LF Bronze		P09290
S-69	816339-011	CI	PD39	
	116339-841	LF Bronze		
H-51	816337-011	CI	60-1 (Old), 60-11 (New)	186384
	116337-841	LF Bronze		186385
H-52	816337-011	CI	60-2 (Old)	186386
	116337-841	LF Bronze		
H-53	816337-011	CI	60-3 (Old), 60-13 (New)	186389
	116337-841	LF Bronze		P57130
H-54	816338-011	CI	60-4 (Old), 60-14 (New)	186392
	116338-841	LF Bronze		P57200
H-63 to	816397-011	CI	60-5 to 60-7 (Old),	—
H-65	116397-841	LF Bronze	60-15 to 60-17 (New)	
H-66 to	816174-011	CI	60-8 to 60-10 (Old),	—
H-68	116174-841	LF Bronze	60-15 to 60-21 (New)	

CIRCULATORS | PARTS LOOK UP



MODEL NUMBER

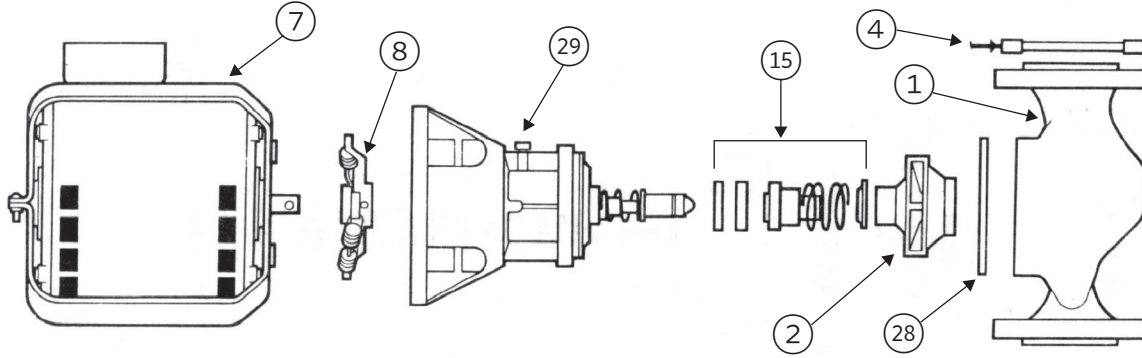
ITT/B&G 75 TO 150

ARMSTRONG S-25 STD/BF/AB

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	805316-010	111034
②⑨	Universal seal bearing assembly (w/noryl impeller)	810119-001 (Sleeve design)	118844LF/ 189034LF
		810119-001 (MF design)	N/A
②	Bronze impeller	812961-041	118431LF
②	Steel impeller	812961-011	118840LF
②	Noryl impeller	812961-111	189132LF
⑧	Coupler	806026-001	189110/118705
②⑧	Body gasket	104442-000	P04080
④	Flange gasket	805176-000*	118368
④	Flange gasket kit	816653-000	Armstrong only
①⑤	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	105482-841	118413LF
①	Cast iron body	805482-011	118339

*Gasket kit contains 2 – 116653-000 gaskets and 2 – 105176-000 gaskets.
For flanges: See flanges cross reference sheet.

CIRCULATORS | PARTS LOOK UP



ITT/B&G 2"

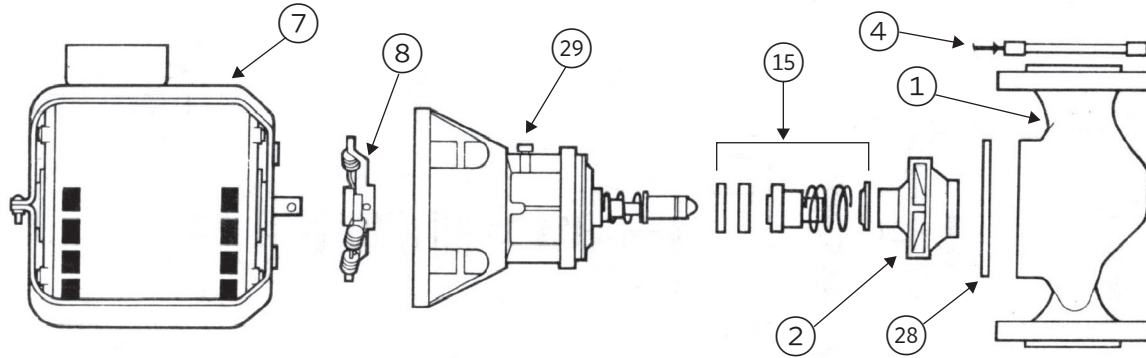
ARMSTRONG S-35 BF/AB

(MFTD. PRIOR TO 7/76, DATE CODE GT)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	817025-001	111036, 111031
②⑨	Universal seal bearing assembly (w/noryl impeller)	810119-003 (Sleeve design)	189100 189103
		810119MF-003 (MF design)	N/A
②	Bronze impeller	816556-041	P07792
②	Steel impeller	816556-011	118668
⑧	Coupler	806026-001	118705/189110
②⑧	Body gasket	106049-000	P04890
④	Flange gasket prior 1967	805209-000	118065
④	Flange gasket new	N/A	N/A
①⑤	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	116327-841	N/A
①	Cast iron body	816327-011	N/A

For flanges: See flanges cross reference sheet.

CIRCULATORS | PARTS LOOK UP



ITT/B&G HV

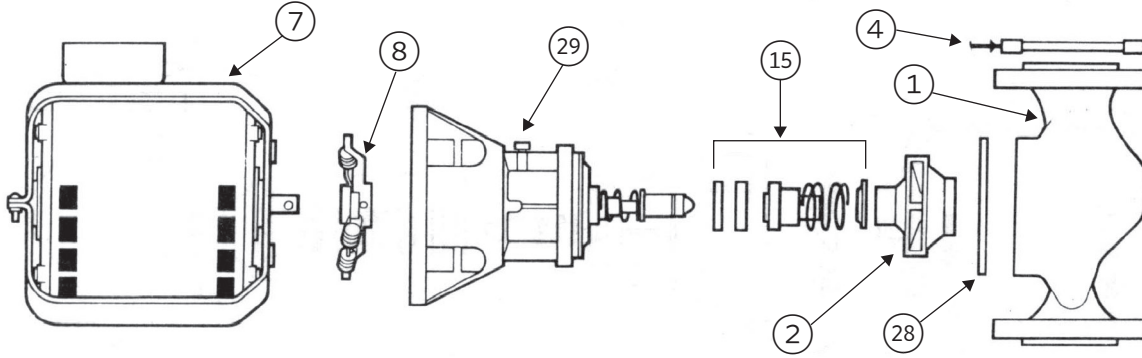
ARMSTRONG H-32 BF/AB

(MFTD. PRIOR TO 4/76, DATE CODE DT)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	817025-001	111036, 111031
②⑨	Universal seal bearing assembly (w/noryl impeller)	810119-003 (Sleeve design)	189165LF/ 189166LF
②⑨		810119MF-003 (MF design)	N/A
②	Bronze impeller	816322-041	P07792
②	Steel impeller	816322-011	118668
②	Noryl impeller	816322-111	N/A
⑧	Coupler	806026-001	118705/189110
②⑧	Body gasket	106049-000	P04890
④	Flange gasket prior 1967	804034-000	118373
④	Flange gasket new	N/A	N/A
①⑤	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	116402-841	118642
①	Cast iron body	816402-011	118641

For flanges: See flanges cross reference sheet.

CIRCULATORS | PARTS LOOK UP



ITT/B&G 2"

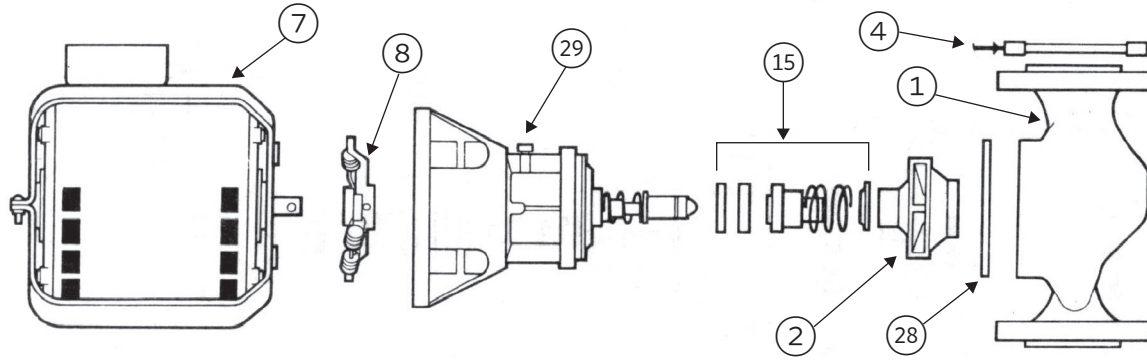
(MFTD. 7/76 OR AFTER, DATE CODE DT)

ARMSTRONG S-35

FOR B&G PUMPS ONLY

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	817025-005	111061
⑲	Seal bearing assembly (Sleeve design)	816023-001	189165LF/ 189166LF
⑲	Seal bearing assembly (MF design)	816023MF-001	N/A
②	Bronze impeller	N/A	189128
②	Steel impeller	N/A	P07792
②	Noryl impeller	N/A	N/A
⑧	Coupler	806026-001	118705/189110
⑳	Body gasket	106049-000	P04890
④	Flange gasket	805209-000	118065
④	Flange gasket new	N/A	N/A
⑮	Seal kit	816706-021	118681
①	Bronze body	N/A	189127
①	Cast iron body	N/A	189126

CIRCULATORS | PARTS LOOK UP

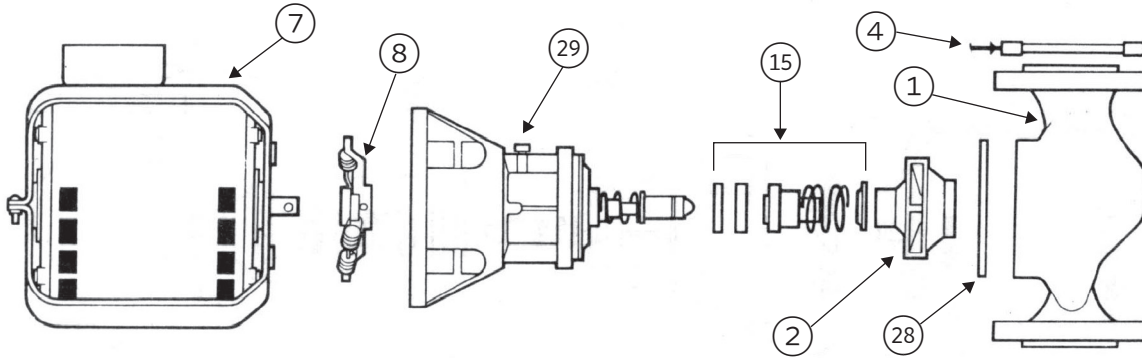


ITT/B&G 2½"

ARMSTRONG S-45 BF 2½" FLANGE

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¼ hp motor	817025-007	111040
⑲	Seal bearing assembly (Sleeve design)	816027-002	189105LF
⑲	Seal bearing assembly (MF design)	816027MF-002	N/A
②	Bronze impeller	816305-058	118440LF
②	Steel impeller	816305-028	118676
②	Noryl impeller	816305-328	N/A
⑧	Coupler	806168-001	118723
⑳	Body gasket	106050-000	P05800
④	Flange gasket	805201-000	118129
④	Flange gasket new	N/A	N/A
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	105484-841	P07610
①	Cast iron body	805484-011	118644

CIRCULATORS | PARTS LOOK UP



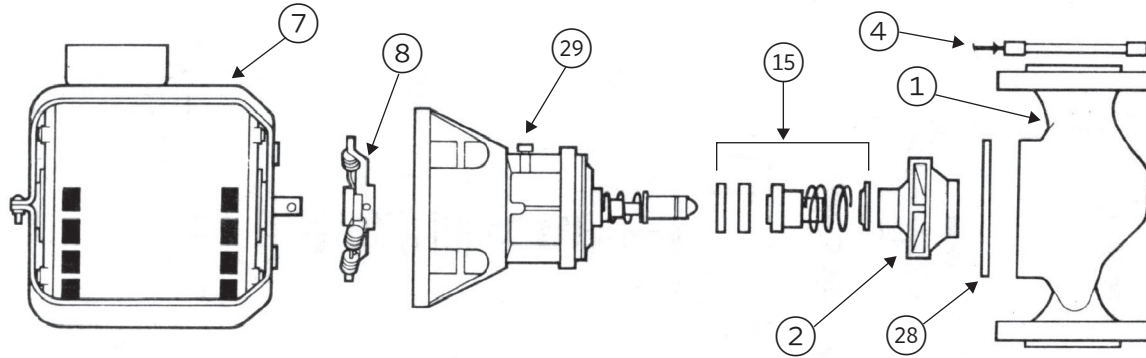
ITT/B&G LD3

ARMSTRONG S-45 BF 3" FLANGE

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¼ hp motor	817025-007	111040
⑲	Seal bearing assembly (Sleeve design)	816027-002	189105LF
⑲	Seal bearing assembly (MF design)	816027MF-002	N/A
②	Bronze impeller	816305-058	118440LF
②	Steel impeller	816305-028	118676
②	Noryl impeller	816305-328	N/A
⑧	Coupler	806168-001	118723
⑳	Body gasket	106050-000	P05800
④	Flange gasket	805201-000	118129
④	Flange gasket new	N/A	N/A
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	105484-841	P07610
①	Cast iron body	805484-011	118644

For flanges: See flanges cross reference sheet.

CIRCULATORS | PARTS LOOK UP

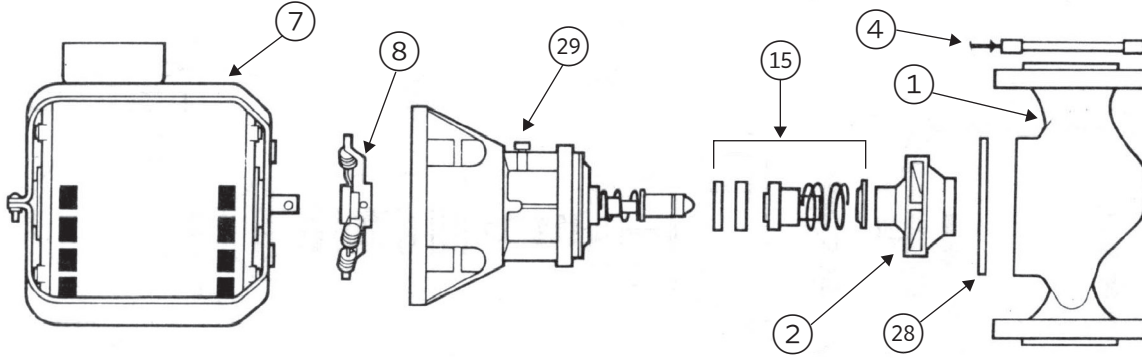


ITT/B&G HD3

ARMSTRONG S-46

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	817025-013	111042
⑲	Seal bearing assembly (Sleeve design)	816027-002	189105LF
⑲	Seal bearing assembly (MF design)	816027MF-002	N/A
②	Bronze impeller	816305-055	118439LF
②	Steel impeller	816305-025	118675
②	Noryl impeller	816305-328	N/A
⑧	Coupler	806168-001	118723
⑳	Body gasket	106050-000	P05800
④	Flange gasket	805201-000	118129
④	Flange gasket new	N/A	N/A
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	105484-841	P07610
①	Cast iron body	805484-011	118644

CIRCULATORS | PARTS LOOK UP

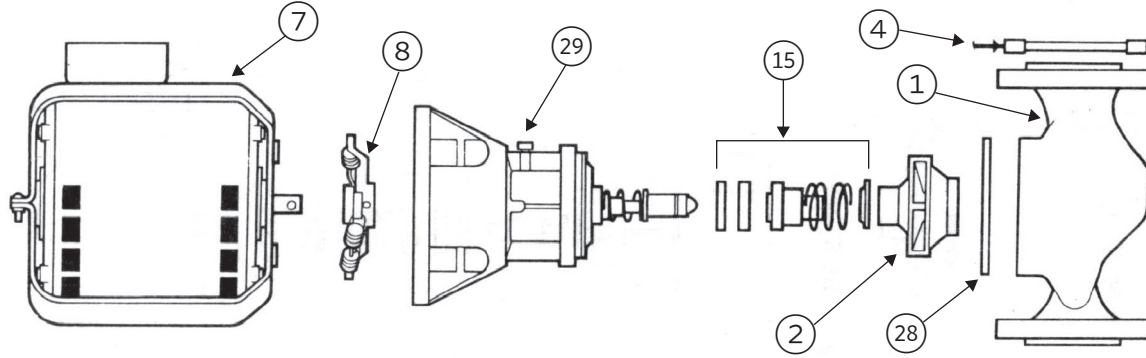


ITT/B&G 1 PR

ARMSTRONG H-41 BF & AB

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor	817025-001	111036/111031
⑲	Seal bearing assembly (Sleeve design)	816027-002	189105LF
⑲	Seal bearing assembly (MF design)	816027MF-002	N/A
②	Bronze impeller	816301-055	118612LF
②	Steel impeller	816301-025	118830
②	Noryl impeller	816301-325	N/A
⑧	Coupler	806026-001	118705/189110
⑳	Body gasket	106050-000	P05800
④	Flange gasket	805176-000	118368
④	Flange gasket new	N/A	N/A
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	111240-841	P07570
①	Cast iron body	811240-011	118637

CIRCULATORS | PARTS LOOK UP



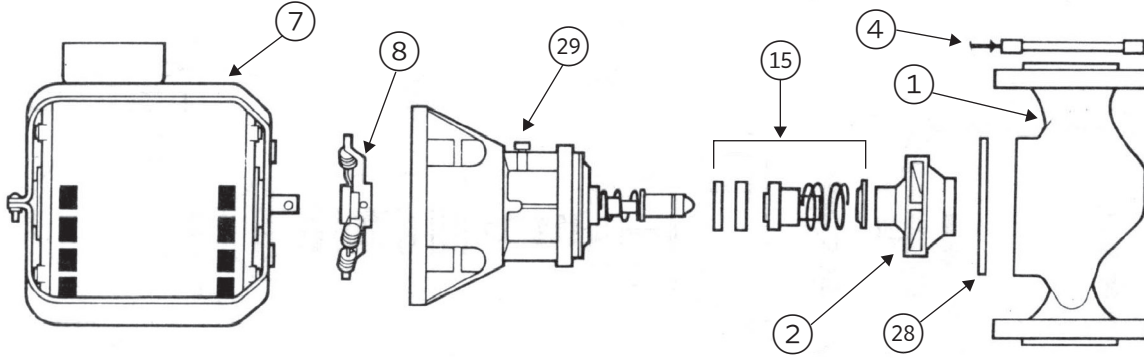
ITT/B&G PD-35

ARMSTRONG S-55

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor 1PH/60/115/230	811757-001	111044
⑦	½ hp motor 3PH/60/208/230/460	811757-020	111046
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816304-051	118627
②	Steel impeller	816304-021	118630
②	Noryl impeller	816304-321	N/A
⑧	Coupler ½" × ⅝"	806137-000	118709
⑧	Coupler ½" × ¾"	806140-000	118708
⑳	Body gasket	106158-000	P57410
④	Flange gasket	805201-000	118129
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	104133-841	P09290
①	Cast iron body	804133-011	118449

CIRCULATORS | PARTS LOOK UP



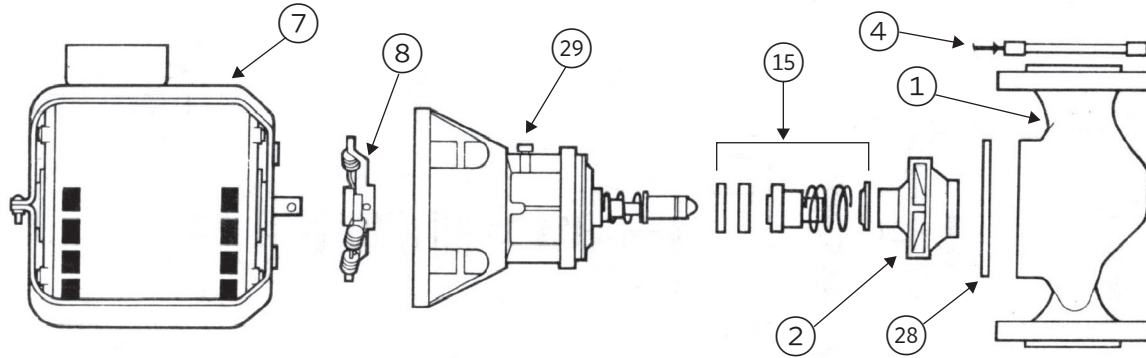
ITT/B&G PD-37

ARMSTRONG S-57

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¾ hp motor 1PH/60/115/230	811757-002	111047
⑦	¾ hp motor 1PH/60/115/230	831010-062	
⑦	¾ hp motor 3PH/60/208/230/460	831012-083	111049
⑦	¾ hp motor 3PH/60/575	811757-006	
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816304-047	118626
②	Steel impeller	816304-027	118629
②	Noryl impeller	816304-317	N/A
⑧	Coupler ½" × ⅝"	806137-000	118709
⑧	Coupler ½" × ¾"	806140-000	118708
⑳	Body gasket	106158-000	P57410
④	Flange gasket	805201-000	118129
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	104133-841	P09290
①	Cast iron body	804133-011	118449

CIRCULATORS | PARTS LOOK UP



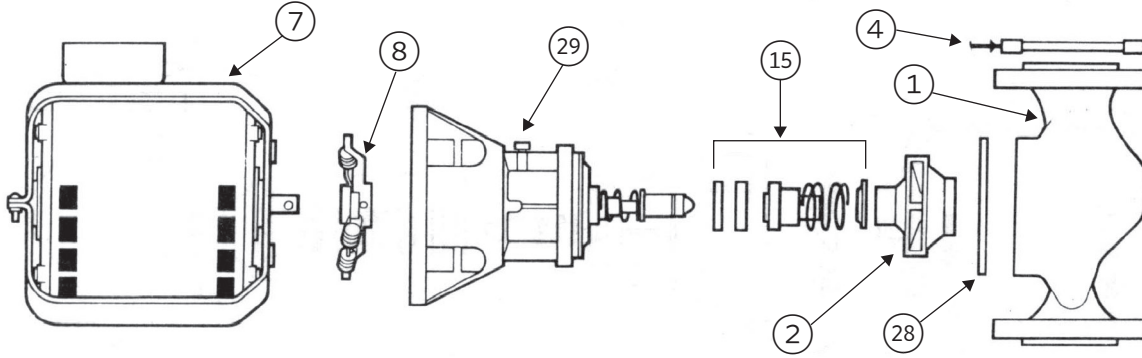
ITT/B&G 60-1 (OLD), 60-11 (NEW)

ARMSTRONG H-51

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¼ hp motor 1PH/60/115/230	816141-001	111040
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816302-049	186359/186360LF
②	Steel impeller	816302-019	186441
②	Noryl impeller	816302-319	N/A
⑧	Coupler	807436-000	118473
⑳	Body gasket	106158-000	P57410
④	Flange gasket	805176-000	118368
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead free)	116337-841	186385
①	Cast iron body	816337-011	186384

CIRCULATORS | PARTS LOOK UP

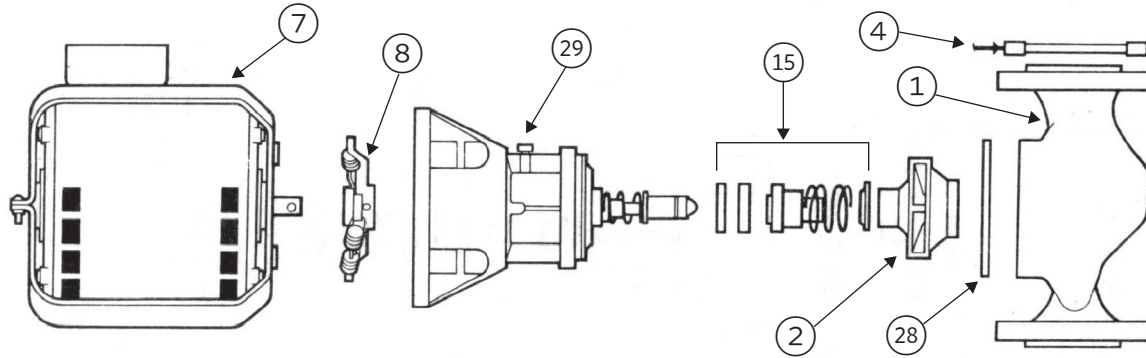


ITT/B&G 60-2 (OLD)

ARMSTRONG H-52 BF SINGLE PHASE
(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor 1PH/60/115/230	816141-002	169038
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816302-047	186359
②	Steel impeller	816302-017	186441
②	Noryl impeller	816302-317	N/A
⑧	Coupler	807436-000	118473
⑳	Body gasket	106158-000	P57410
④	Flange gasket	805176-000	118368
⑮	Seal kit	816706-023	118681
①	Bronze body (Lead Free)	116337-841	N/A
①	Cast iron body	816337-011	186386

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-3 (OLD), 60-13 (NEW)

ARMSTRONG H-53 BF & AB

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	½ hp motor 1PH/60/115/230	811757-001	111044
⑦	½ hp motor 3PH/60/208/230/460	831011-083	111046
⑦	½ hp motor 3PH/60/575	811757-004	
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816303-047	186368
②	Steel impeller	816303-017	P61010
②	Noryl impeller	816303-317	N/A
⑧	Coupler ½" × ⅝"	806137-000	118709
⑳	Body gasket	106158-000	P57410
④	Flange gasket	805176-000	118368
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	116337-841	N/A
①	Cast iron body	816337-011	186386

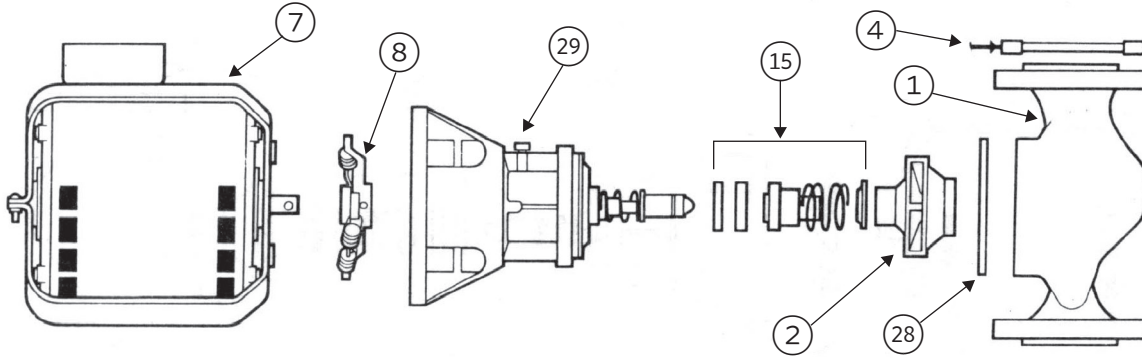
Note:

When replacing B&G with Armstrong equivalent for ½ and ¾ you must also change the coupler

B&G has ½" motor shaft

Armstrong has ⅝" motor shaft

CIRCULATORS | PARTS LOOK UP



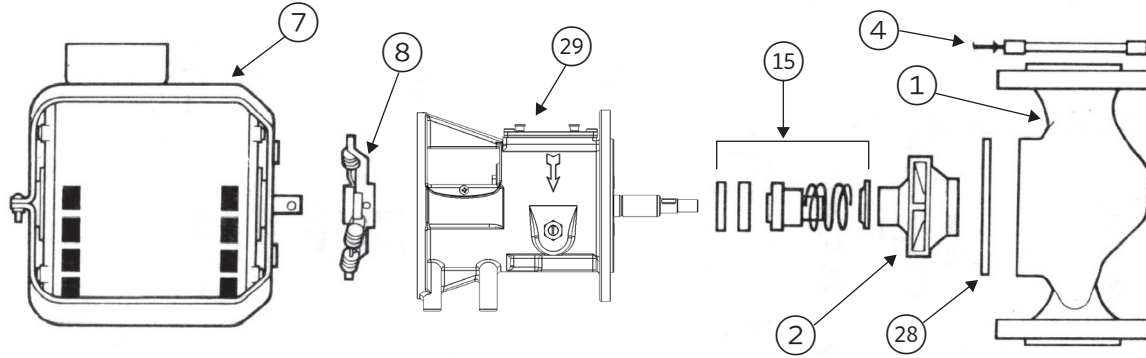
ITT/B&G 60-4 (OLD), 60-14 (NEW)

ARMSTRONG H-54 BF & AB

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¾ hp motor 1PH/60/115/230	811757-002	111047
⑦	¾ hp motor 3PH/60/208/230/460	831012-083	111049
⑦	¾ hp motor 3PH/60/575	811757-006	
⑲	Seal bearing assembly (Sleeve design)	816032-000	186863LF/186864LF
⑲	Seal bearing assembly (MF design)	816032MF-000	N/A
②	Bronze impeller	816304-047	118626
②	Steel impeller	816304-017	118629
②	Noryl impeller	816304-317	N/A
⑧	Coupler ½" × ⅝"	806137-000	118709
⑳	Body gasket	106158-000	P57410
④	Flange gasket	816117-000	118378
⑮	Seal kit	816706-021	118681
①	Bronze body (Lead Free)	116338-841	P57200
①	Cast iron body	816338-011	186392

CIRCULATORS | PARTS LOOK UP



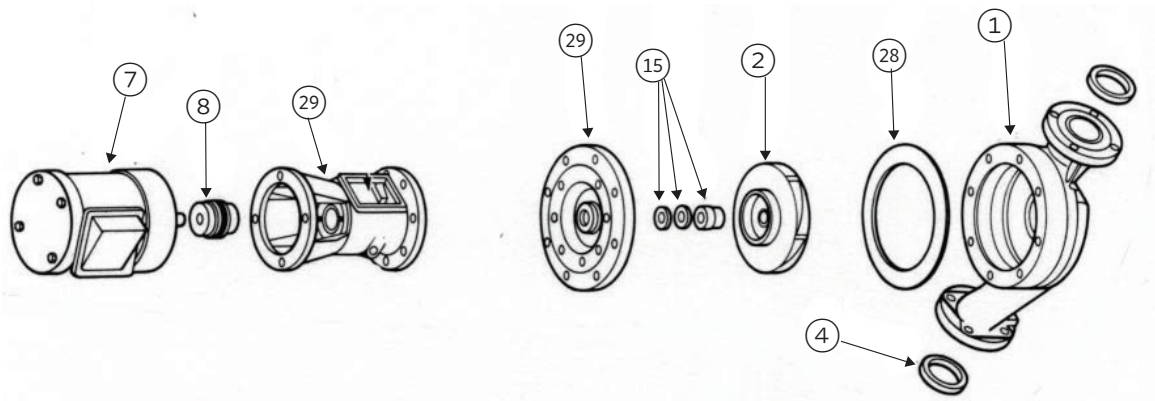
ITT/B&G PD-38, PD-40

ARMSTRONG S-69

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1ph/60/115/230	816676-062	169232
⑦	1 hp motor 3ph/60/208/230/460	816676-069	169233
⑦	1 hp motor 3ph/60/575	811757-009	
⑲	Seal bearing assembly (Sleeve design)	816366-041	185260/185262
②	Bronze impeller	816308-042	P08690
②	Steel impeller	816308-012	P08709
⑧	Coupler assembly/flexible 5/8 x 5/8	816665-000	186004/186003
⑳	Body gasket	106592-000	118129
④	Flange gasket	105201-000	
⑮	Seal kit	816707-001	186433
①	Bronze body	816339-011	

CIRCULATORS | PARTS LOOK UP



MODEL NUMBER

ITT/B&G PD-39

ARMSTRONG - NO EQUIVALENT

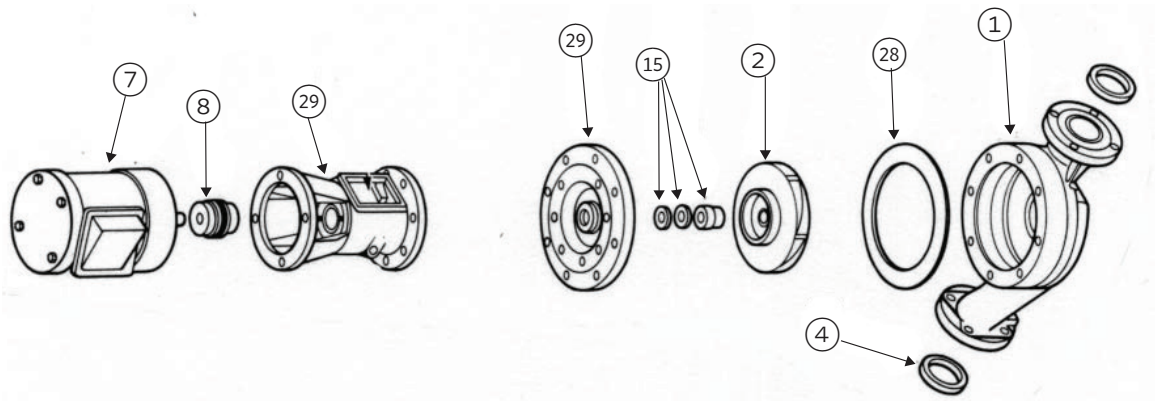
(MFTD. PRIOR TO 10/77, DATE CODED KU)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
⑳	Seal bearing assembly (STD./B.F.)	816133-000**	185232
⑳	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816311-041	118453
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	812734-000	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
㉘	Body gasket	106592-000	P57700
④	Flange gasket	805201-000	118129
⑮	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
 #20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



ITT/B&G PD-39

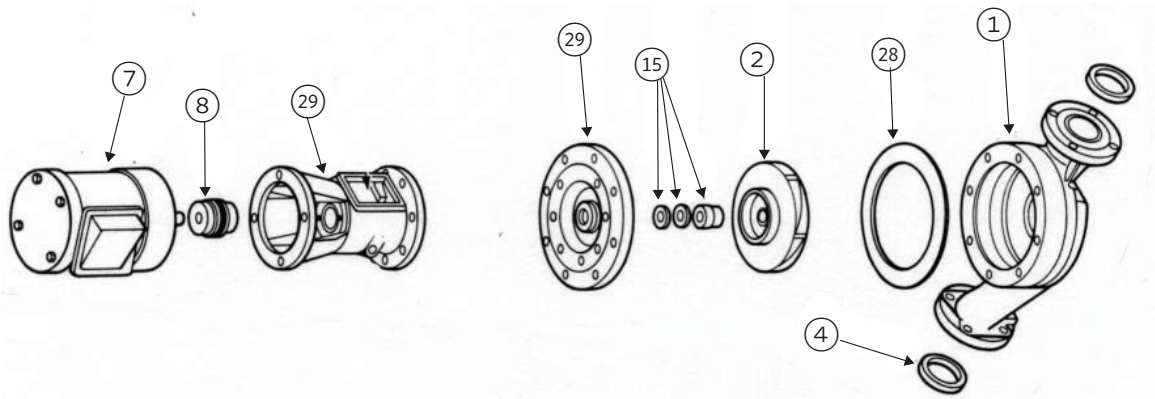
ARMSTRONG - NO EQUIVALENT

(MFTD. PRIOR TO 10/77 OR AFTER , DATE CODED KU)

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
②⑨	Seal bearing assembly (STD./B.F.)	816133-000**	185260
②⑨	Seal bearing assembly (A.B.)	816134-000**	185262
②	Bronze impeller	816311-041	118453
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	810120-008	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
②⑧	Body gasket	106592-000	P57700
④	Flange gasket	805201-000	118129
①⑤	Seal kit	810120-009	186499

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-5 (OLD), 60-15 (NEW) ARMSTRONG - NO EQUIVALENT
 (MFTD. PRIOR TO 10/77 OR AFTER, DATE CODED KU)

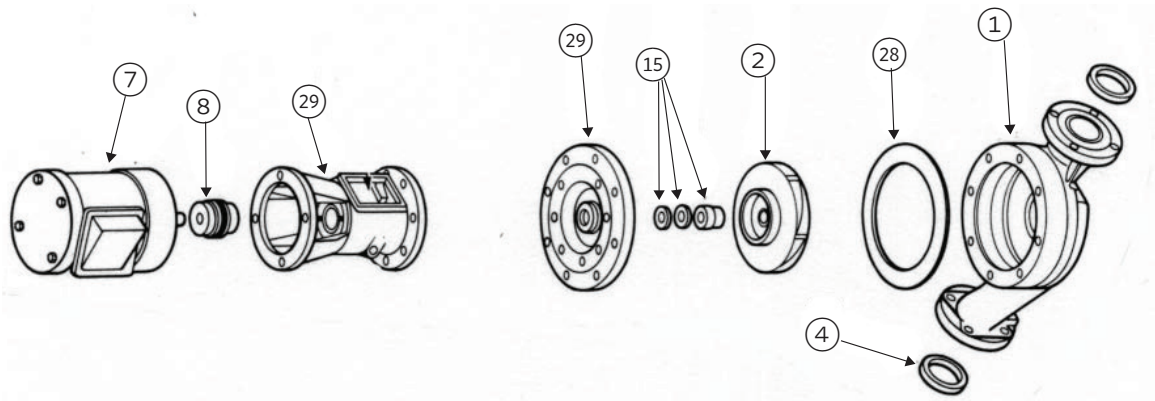
(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B & G
⑦	½ hp motor 1PH/60/115/230	811757-001	111044
⑦	½ hp motor 3PH/60/208/230/460	811757-020	111046
②⑨	Seal bearing assembly (STD./B.F.)	816133-000**	185232
②⑨	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816309-041	P57445
②	Steel impeller	N/A	N/A
⑧	Coupler ⅝" × ½"	810120-008	186410
⑧	Coupler ⅝" × ⅝"	816665-000	118476/P77265
②⑧	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
①⑤	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
 #20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-6 (OLD), 60-16 (NEW)

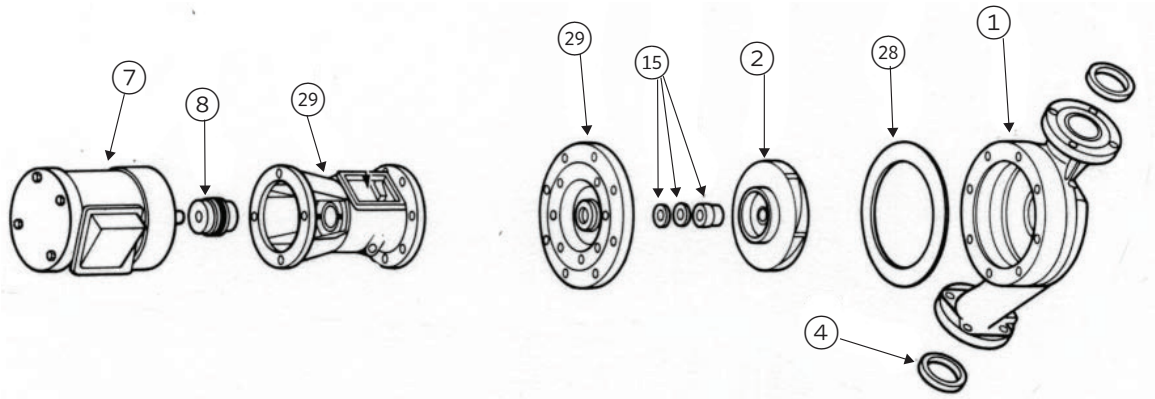
(MFTD. PRIOR TO 10/77, DATE CODED KU)

ARMSTRONG - NO EQUIVALENT

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¾ hp motor 1PH/60/115/230	811757-002	111047
⑦	¾ hp motor 3PH/60/208/230/460	831012-083	111049
⑲	Seal bearing assembly (STD./B.F.)	816133-000**	185232
⑲	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816309-041	P57445
②	Steel impeller	N/A	N/A
⑧	Coupler ⅝" × ½"	810120-008	186410
⑧	Coupler ⅝" × ⅝"	816665-000	118476/P77265
⑳	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
⑮	Seal kit	810120-009	186499

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-9 (OLD), 60-19 (NEW)

(MFTD. PRIOR TO 10/77, DATE CODED KU)

ARMSTRONG - NO EQUIVALENT

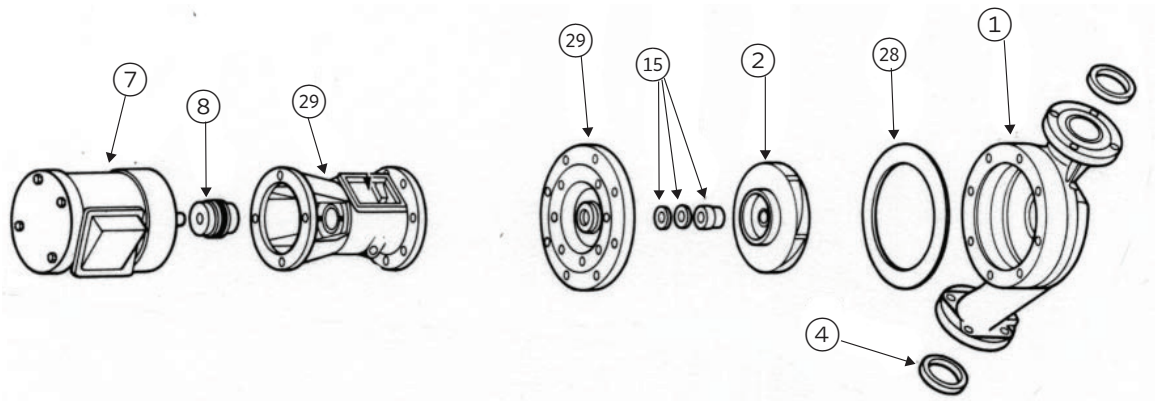
(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
②⑨	Seal bearing assembly (STD./B.F.)	816133-000**	185232
②⑨	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816310-041	P57450
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	810120-008	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
②⑧	Body gasket	106592-000	P57700
④	Flange gasket	816117-000	118378
①⑤	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
 #20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-7 (OLD), 60-17 (NEW)

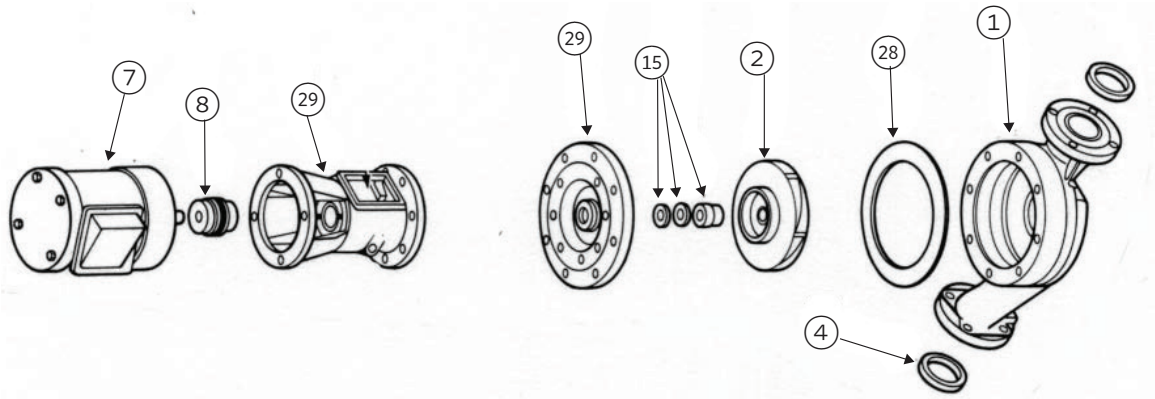
ARMSTRONG - NO EQUIVALENT

(MFTD. PRIOR TO 10/77, DATE CODED KU)

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
②⑨	Seal bearing assembly (STD./B.F.)	816133-000**	185232
②⑨	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816309-041	P57445
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	810120-008	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
②⑧	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
①⑤	Seal kit	810120-009	186499

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-10 (OLD), 60-20 (NEW)
 (MFTD. PRIOR TO 10/77, DATE CODED KU)

ARMSTRONG - NO EQUIVALENT

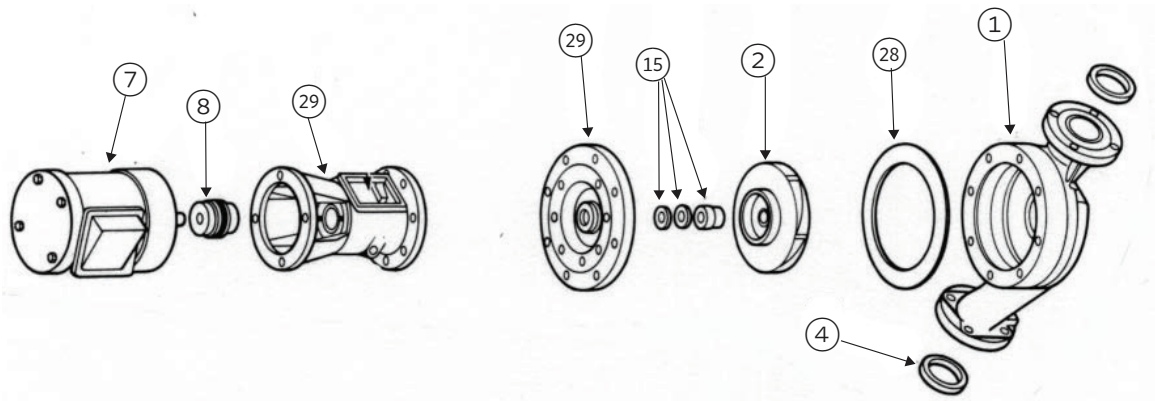
(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1½ hp motor 1PH/60/115/230	816678-062	169005
⑦	1½ hp motor 3PH/60/208/230/460	816678-069	169091/169092
②⑨	Seal bearing assembly (STD./B.F.)	816133-000**	185232
②⑨	Seal bearing assembly (A.B.)	816134-000**	185234
②	Bronze impeller	816310-041	P57450
②	Steel impeller	N/A	N/A
⑧	Coupler ⅝" × ½"	810120-008	186410
⑧	Coupler ⅝" × ⅝"	816665-000	118476/P77265
②⑧	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
①⑤	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
 #20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-6 (OLD), 60-16 (NEW)

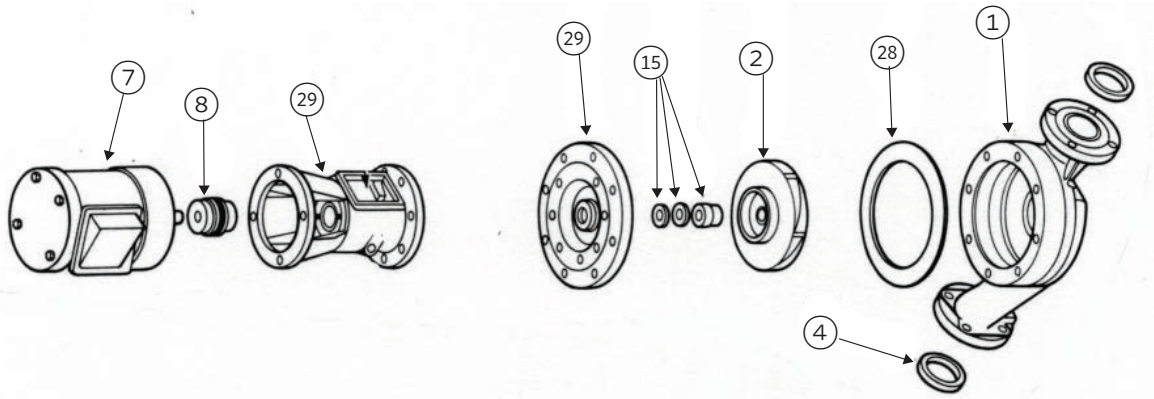
ARMSTRONG - NO EQUIVALENT

(MFTD. PRIOR TO 10/77 OR AFTER, DATE CODED KU)

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	¾ hp motor 1PH/60/115/230	811757-002	111047
⑦	¾ hp motor 3PH/60/208/230/460	831012-083	111049
⑳	Seal bearing assembly (STD./B.F.)	816133-000**	185260
⑳	Seal bearing assembly (A.B.)	816134-000**	185262
②	Bronze impeller	816309-041	P57445
②	Steel impeller	N/A	N/A
⑧	Coupler ⅝" × ½"	810120-008	186410
⑧	Coupler ⅝" × ⅝"	816665-000	118476/P77265
㉘	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
⑮	Seal kit	810120-009	186499

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-7 (OLD), 60-17 (NEW)
 (MFTD. PRIOR TO 10/77 OR AFTER, DATE CODED KU)

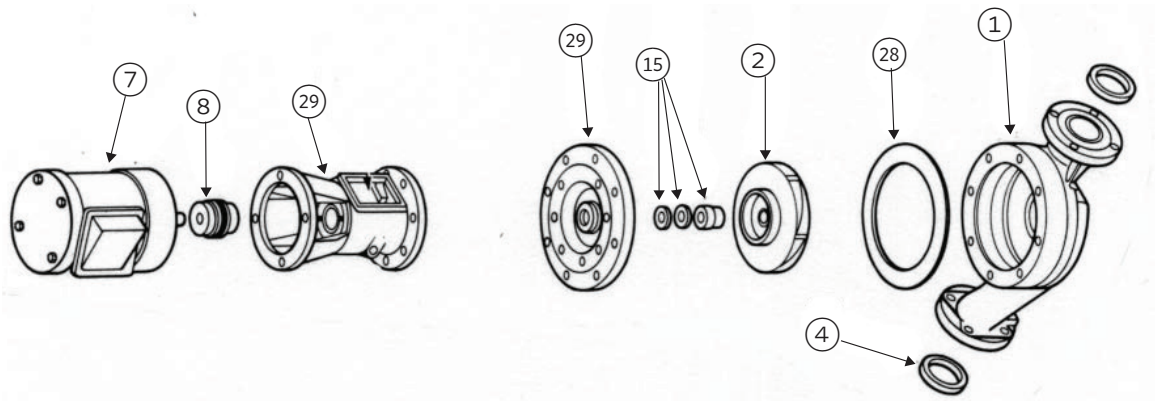
ARMSTRONG - NO EQUIVALENT

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
⑳	Seal bearing assembly (STD./B.F.) (STANDARD CONSTRUCTION IS BRONZE FITTED)	816133-000**	185260
⑳	Seal bearing assembly (A.B.)	816134-000**	185262
②	Bronze impeller	816309-041	P57445
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	810120-008	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
㉘	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
⑮	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
 #20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-9 (OLD), 60-19 (NEW)

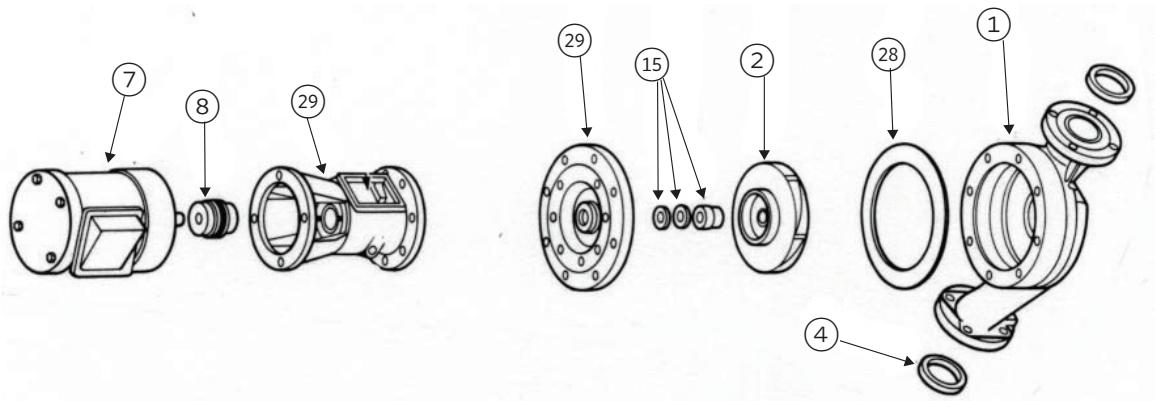
ARMSTRONG - NO EQUIVALENT

(MFTD. PRIOR TO 10/77 OR AFTER, DATE CODED KU)

(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1 hp motor 1PH/60/115/230	811757-007	111050
⑦	1 hp motor 3PH/60/208/230/460	811757-028	111051
⑲	Seal bearing assembly (STD./B.F.)	816133-000**	185260
⑲	Seal bearing assembly (A.B.)	816134-000**	185262
②	Bronze impeller	816310-041	P57450
②	Steel impeller	N/A	N/A
⑧	Coupler 5/8" x 1/2"	810120-008	186410
⑧	Coupler 5/8" x 5/8"	816665-000	118476/P77265
⑳	Body gasket	106592-000	P57700
④	Flange gasket	816117-000	118378
⑮	Seal kit	810120-009	186499

CIRCULATORS | PARTS LOOK UP



ITT/B&G 60-10 (OLD), 60-20 (NEW) ARMSTRONG - NO EQUIVALENT
(MFTD. PRIOR TO 10/77 OR AFTER, DATE CODED KU)

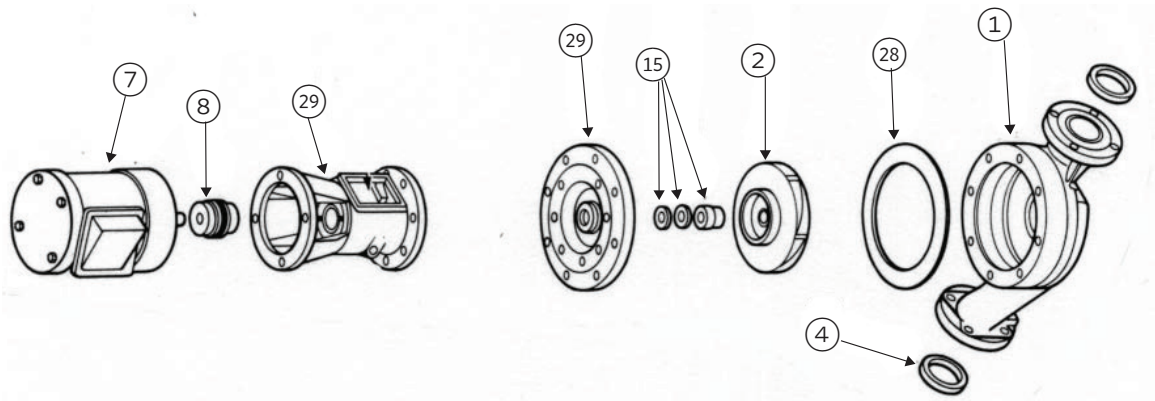
(STANDARD CONSTRUCTION IS BRONZE FITTED)

ITEM NUMBER	PART DESCRIPTION	PART NUMBER	
		ARMSTRONG	B&G
⑦	1½ hp motor 1PH/60/115/230	816678-062	169005
⑦	1½ hp motor 3PH/60/208/230/460	816678-069	169091/169092 111052
⑳	Seal bearing assembly (STD./B.F.)	816133-000**	185260
⑳	Seal bearing assembly (A.B.)	816134-000**	185262
②	Bronze impeller	816310-041	P57450
②	Steel impeller	N/A	N/A
⑧	Coupler ⅝" × ½"	810120-008	186410
⑧	Coupler ⅝" × ⅝"	816665-000	118476/P77265
㉘	Body gasket	106592-000	P57700
④	Flange gasket	804034-000	118373
⑮	Seal kit	810120-009	186499

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these Bearing Assemblies. These Bearing Assemblies include the following Cover Plates and are supplied with Part Number 817607-001 Seal Kit and Body Gasket:

#20 FOR STD. & B.F. 816347-011
#20 FOR A.B. 816347-041

CIRCULATORS | PARTS LOOK UP



FOR B&G PUMPS ONLY

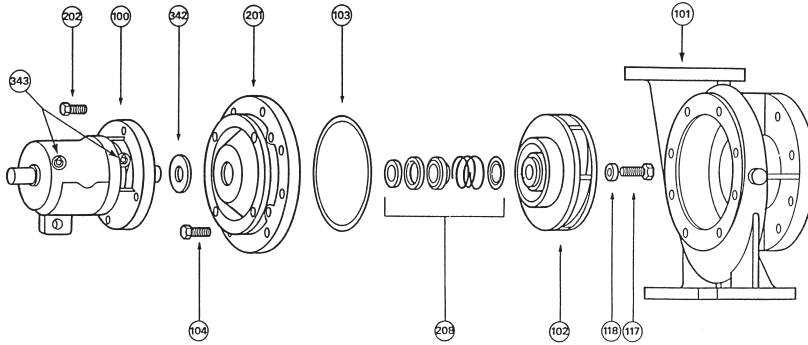
DESCRIPTION	PART NUMBER	
	ARMSTRONG	B&G
2" - SBA	816023-001	189129-189120
2" - 1/6 HP MOTOR	817025-005	111061
SBA for PD-39, 60-5, 60-6, 60-7, 60-9 & 60-10 60-15, 60-16, 60-17, 60-19 & 60-20	816133-000***	185260 Std/BF Old #PD26Z-12351 185232 Std/BF Old #PD25Z-12351
Same as above	816134-000***	185262 AB 185234 AB
HD3 - 1/2 HP MOTOR	816025-013	111042

****NOTE:** Use the B&G Impeller (with pressure balance holes) with these bearing assemblies. These seal bearing assemblies include the 816366-041 bearing assembly, 816707-001 seal kit, and either the 816347-011 Std./B.F. cover plate of the 816347-041 A.B.

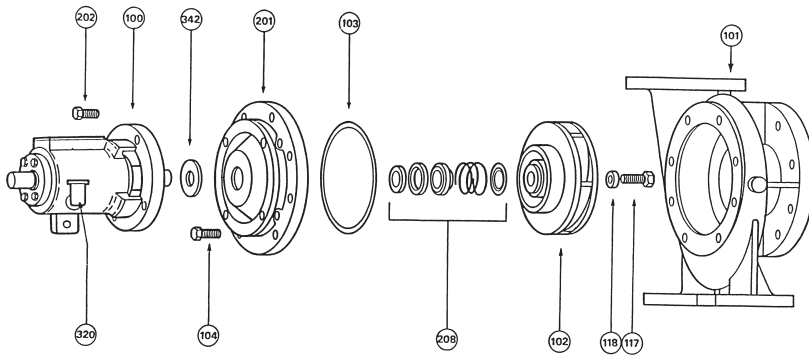
4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

MODEL 4030



MODEL 4020



ITEM	DESCRIPTION
100	Bearing frame assembly
101	Volute
102	Impeller
103	Volute gasket
104	Volute capscrew
117	Impeller capscrew
118	Impeller washer
201	Volute cover plate

ITEM	DESCRIPTION
202	Cover plate capscrew
208	Mechanical seal assembly
320	
342	Water slinger
343	
401	Coupler selection table (wooden type)
407	Coupler insert selection table (wooden type)

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

MODEL NUMBER

B&G MODEL 1510 | ARMSTRONG MODEL 4030 BEARING FRAMES, ALL SPEEDS

MOTOR HP AND SPEED	1200RPM	½	¾	1	1½	2	3	5	7½	10	-	-	15	20	-	-	25	30	-
	1800RPM	¾	1	1½ & 2	3	5	7½	10	15	20	-	-	25	30	-	-	40	50	-
3600RPM	-	-	-	-	5	7½	10	15	20	25	30	40	-	-	50	60	-	-	75
FRAME SIZE	1954 RERATE	56	182	184	213	215	254U	256U	284U	286U	324S	326S	324U	326U	364US	365US	364U	365U	404US
	1964 RERATE	56	143T	145T	182T	184T	213T	215T	254T	256T	284TS	286TS	284T	286T	324TS	326TS	324T	326T	364TS
PUMP SIZE																			
B&G	ARMSTRONG																		
1¼A	1¼D	S	S	S	S	S	S	S	-	-	-	-	-	-	-	-	-	-	-
1½A	1½D	S	S	S	S	S	S	S	M	M	-	-	-	-	-	-	-	-	-
2A	2D	S	S	S	S	S	S	S	M	M	-	-	-	-	-	-	-	-	-
2½A	2½D	S	S	S	S	S	S	S	M	M	M	M	-	-	-	-	-	-	-
3A	3D	-	S	S	S	S	S	S	M	M	M	M	-	-	-	-	-	-	-
4A	4D	-	S	S	S	S	S	S	M	M	M	M	-	-	-	-	-	-	-
1¼BB	1¼E	-	S	S	S	S	S	S	M	M	M	M	-	-	-	-	-	-	-
1½BB	1½E	-	S	S	S	S	S	S	M	M	M	M	-	-	-	-	-	-	-
2BB	2E	-	S	S	S	S	S	S	M	M	M	M	-	-	M	M	-	-	-
2½B	2½E	-	-	-	S	S	S	S	-	-	-	-	-	-	-	-	-	-	-
3BB	3E	-	-	-	S	S	S	S	M	-	-	-	-	-	-	-	-	-	-
4BB	4E	-	-	-	-	S	S	S	M	M	-	-	-	-	-	-	-	-	-
5BB	5E	-	-	-	-	-	S	S	M	M	-	-	M	-	-	-	-	-	-
6BB	6E	-	-	-	-	-	-	-	M	M	-	-	M	-	-	-	-	-	-
2C	2G	-	-	-	-	M	M	M	-	-	-	-	-	-	-	-	-	-	-
3C	3G	-	-	-	-	-	M	M	M	M	-	-	-	-	-	-	-	-	-
4C	4G	-	-	-	-	-	-	M	M	M	-	-	M	M	-	-	-	-	-
6C	6G	-	-	-	-	-	-	-	-	M	-	-	M	M	-	-	M	M	M

s designation - ⅞" impeller bore, 1¼" mechanical seal

m designation - 1¼" impeller bore, 1½" mechanical seal

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

MODEL NUMBER									
B&G MODEL UNIVERSAL		ARMSTRONG MODEL 4020 BEARING FRAMES, 1750 RPM							
MOTOR HP AND SPEED	1750RPM	½ & ¾	1	1½ & 2	3	5	7½	10	15
FRAME SIZE	1954 RERATE	56	182	184	213	215	254U	256U	284U
	1964 RERATE	56	143T	145T	182T	184T	213T	215T	254T
PUMP SIZE									
B&G	ARMSTRONG								
U1¼A	1¼D	S	S	S	-	-	-	-	-
U1½A	1½D	S	S	S	-	-	-	-	-
U2A	2D	S	S	S	-	-	-	-	-
U2½A	2½D	S	S	S	S	-	-	-	-
U3A	3D	-	S	S	S	-	-	-	-
U4A	4D	-	-	S	S	S	-	-	-
U1¼B	1¼E	-	S	S	S	S	-	-	-
U1½B	1½E	-	-	S	S	S	-	-	-
U2B	2E	-	-	S	S	S	S	-	-
U2½B	2½E	-	-	-	S	S	S	S	-
U3B	3E	-	-	-	-	S	S	S	-
U4B	4E	-	-	-	-	S	S	S	S
U5B	5E	-	-	-	-	-	S	S	S

s designation - 7/8" impeller bore, 1¼" mechanical seal

when replacing the bearing frame assembly on pumps with these motor frame sizes, use the 1510/4030 bearing frame assembly. part no. 819359-002

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 101 VOLUTE

PUMP SIZE		MATERIAL	PART NUMBER	
B&G	ARMSTRONG		B&G	ARMSTRONG
1¼AB & U1¼A	1¼D	Cast iron	P41240**	415291-011
		Bronze	P41260**	415291-041
1½AB & U1½A	1½D	Cast iron	P41690	415293-011
		Bronze	P41710	415293-041
2AB & U2A	2D	Cast iron	P42070**	425141-011
		Bronze	P42090**	425141-041
2½A & U2½A	2½D	Cast iron	P42360**	425143-011
3A & U3A***	3D	Cast iron	PW-121 ³⁹ **	425145-011
		Bronze	PWB-121**	425145-041
4AB & U4A	4D	Cast iron	P43250**	415299-011
		Bronze	P55280**	415299-041
U1¼B & 1¼BB	1¼E	Cast iron	P41410**	416168-011
		Bronze	P41430**	416168-041
U1½B & 1½BB	1½E	Cast iron	P41780	425147-011
		Cast iron	P14120**	419153-011
U2B & 2BB	2E	Bronze	P42160**	419153-041
		Cast iron	P42480	415297-011
U2½B & 2½B	2½E	Bronze	P55190**	415297-041
		Cast iron	P42740	416180-011
U3B & 3BB	3E	Bronze	P42770	416180-041
		Cast iron	P43310**	415301-011
U4B & 4BB	4E	Bronze	P55320**	415301-041
		Cast iron	P43620**	415303-011
U5B & 5BB	5E	Bronze	P55360**	415303-041
		Cast iron	P43730**	416188-011
U6B & 6BB	6E	Cast iron	P42865	419544-011
		Bronze	—	419544-041
2C	2G	Cast iron	P42880	419003-011
		Bronze	—	419003-041
3C	3G	Cast iron	—	419004-041
		Bronze	—	419004-041
4C	4G	Cast iron	P43810	419542-011
		Bronze	—	419542-041
6C	6G	Cast iron	—	419542-041
		Bronze	—	419542-041

NOTES: ** These volutes are no longer available from B&G. 'STOCK AT ARMSTRONG'

***For pumps built prior to 1964 (serial no. DD) only, use only with impeller part numbers 411868-011 & 411868-041 (7/8" bore) and 419234-011 & 419234-041 (1¼" bore).

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 7/8" BORE

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
1¼AB	1¼D	Bronze	P46630	411852-041	7/8	7
		Cast iron	P46510	411852-011	7/8	7
1½AB	1½D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
2AB	2D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
2½A	2½D	Bronze	P48770	406642-041	7/8	7
		Cast iron	P49000	406642-011	7/8	7
3A***	3D	Bronze	P49480	411868-041	7/8	7
		Cast iron	P49500	411868-011	7/8	7
4AB	4D	Bronze	P56140	411874-041	7/8	7
		Cast iron	P50270	411874-041	7/8	7
1¼BB	1¼E	Bronze	P78523	407922-041	7/8	9½
		Cast iron	P78253	407922-011	7/8	9½
1½BB	1½E	Bronze	P78523	407922-041	7/8	9½
		Cast iron	P78253	407922-011	7/8	9½
2BB	2E	Bronze	P78525	411881-041	7/8	9½
		Cast iron	P78486	411881-011	7/8	9½
2½B	2½E	Bronze	P78525	411881-041	7/8	9½
		Cast iron	P78486	411881-011	7/8	9½
3BB	3E	Bronze	P49620	419465-041	7/8	9½
		Cast iron	P49600	419465-011	7/8	9½
4BB	4E	Bronze	P50550	411940-041	7/8	9½
		Cast iron	P50390	411940-011	7/8	9½
5BB	5E	Bronze	P50930	411941-041	7/8	9½
		Cast iron	P50910	411941-011	7/8	9½

NOTES: *** For pumps built prior to 1964 (Serial no. DD) only, use only with casing part numbers: PW-121 for cast iron and PWB-121 for all bronze

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 1¼" BORE

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
1½AB	1½D	Bronze	P48070	419229-041	1¼	7
		Cast iron	P48050	419229-011	1¼	7
2AB	2D	Bronze	P48070	419229-041	1¼	7
		Cast iron	P48050	419229-011	1¼	7
2½A	2½D	Bronze	P49040	419232-041	1¼	7
		Cast iron	P48980	419232-011	1¼	7
3A***	3D	Bronze	P49480	419234-041	1¼	7
		Cast iron	P49500	419234-011	1¼	7
4AB	4D	Bronze	P50310	419236-041	1¼	7
		Cast iron	P50290	419236-011	1¼	7
1¼BB	1¼E	Bronze	P78251	419238-041	1¼	9½
		Cast iron	P78522	419238-011	1¼	9½
1½BB	1½E	Bronze	P78251	419238-041	1¼	9½
		Cast iron	P78522	419238-011	1¼	9½
2BB	2E	Bronze	P78525	419239-041	1¼	9½
		Cast iron	P78257	419239-011	1¼	9½
2½B	2½E	Bronze	P78255	419239-041	1¼	9½
		Cast iron	P78257	419239-011	1¼	9½
3BB	3E	Bronze	P49640	419241-041	1¼	9½
		Cast iron	P49660	419241-011	1¼	9½
4BB	4E	Bronze	P50570	419243-041	1¼	9½
		Cast iron	P50330	419243-011	1¼	9½
5BB	5E	Bronze	P50970	419245-041	1¼	9½
		Cast iron	P50950	419245-011	1¼	9½
6BB	6E	Bronze	P51290	419247-041	1¼	9½
		Cast iron	P51270	419247-011	1¼	9½
2C	2G	Bronze	P77497	419543-041	1¼	12½
		Cast iron	P77499	419543-011	1¼	12½
3C	3G	Bronze	P49700	419008-041	1¼	12½
		Cast iron	P49680	419008-011	1¼	12½
4C	4G	Bronze	P50450	419009-041	1¼	12½
		Cast iron	P50430	419009-011	1¼	12½
6C**	6G	Bronze	P51370	419541-041	1¼	12½
		Cast iron	P51350	419541-011	1¼	12½

NOTES: ** 6 C & 6G Are mechanically interchangeable, providing both the volute and impeller are of the correct size for the capacity conditions at the same time.

6 G 4030 has a possible capacity equivalent of a B&G 8 C, depending on the selection of the proper impeller diameter and motor of adequate capacity.

*** For pumps built prior to 1964 (serial no. 00) only, use only with casing part numbers: PW-121 for cast iron and PWB-121 for all bronze

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 7/8" BORE & 1 1/4" BORE (CUSTOM SIZE)

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
U1 1/4 A	1 1/4 D	Bronze	P46630	411852-041	7/8	7
		Cast iron	P46510	411852-011	7/8	7
U1 1/2 A	1 1/2 D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
U2 A	2 D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
U2 1/2 A	2 1/2 D	Bronze	P48770	406642-041	7/8	7
		Cast iron	P49000	406642-011	7/8	7
3 A***	3 D	Bronze	P49480	411868-041	7/8	7
		Cast iron	P49500	411868-011	7/8	7
U4 A	4 D	Cast iron	P50270	411874-041	7/8	7
U1 1/4 B	1 1/4 E	Bronze	P78523	407922-041	7/8	9 1/2
		Cast iron	P78253	407922-011	7/8	9 1/2
U1 1/2 B	1 1/2 E	Bronze	P78523	407922-041	7/8	9 1/2
		Cast iron	P78253	407922-011	7/8	9 1/2
U2 B	2 E	Bronze	P78525	411881-041	7/8	9 1/2
		Cast iron	P78486	411881-011	7/8	9 1/2
U2 1/2 B	2 1/2 E	Bronze	P78525	411881-041	7/8	9 1/2
		Cast iron	P78486	411881-011	7/8	9 1/2
U3 B	3 E	Bronze	P49620	419465-041	7/8	9 1/2
		Cast iron	P49600	419465-011	7/8	9 1/2
U4 B	4 E	Bronze	P50550	411940-041	7/8	9 1/2
		Cast iron	P50390	411940-011	7/8	9 1/2
U5 B	5 E	Bronze	P50930	411941-041	7/8	9 1/2
		Cast iron	P50910	411941-011	7/8	9 1/2
U6 B	N/A	Bronze	P51290	419247-041	1 1/4	9 1/2
		Cast iron	P51270	419247-011	1 1/4	9 1/2

NOTES: *** For pumps built prior to 1964 (Serial no. DD) only, use only with casing part numbers: PW-121 for cast iron and PWB-121 for all bronze

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 7/8" BORE & 1 1/4" BORE (STOCK SIZE)

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
U1T	D141	Bronze	P48770	406642-041	7/8	5 1/4
		Cast iron	P49000	406642-011	7/8	5 1/4
U2T	D142	Bronze	P48770	406642-041	7/8	6
		Cast iron	P49000	406642-011	7/8	6
U3T	D143	Bronze	P48770	406642-041	7/8	6 1/2
		Cast iron	P49000	406642-011	7/8	6 1/2
U4T	D144	Bronze	P48770	406642-041	7/8	6 7/8
		Cast iron	P49000	406642-011	7/8	6 7/8
U5T	D145	Bronze	P78525	411881-041	7/8	7 1/4
		Cast iron	P78486	411881-011	7/8	7 1/4
U6T	D146	Bronze	P56140	411874-041	7/8	6 1/2
		Cast iron	P50270	411874-041	7/8	6 1/2
U7T	D147	Bronze	P78525	411881-041	7/8	8
		Cast iron	P78486	411881-011	7/8	8
U8T	D148	Bronze	P50930	411941-041	7/8	7 1/4
		Cast iron	P50910	411941-011	7/8	7 1/4
U9T	1 1/4D	Bronze	P78525	411881-041	7/8	9
		Cast iron	P78486	411881-011	7/8	9
U10T	1 1/2D	Bronze	P50930	411941-041	7/8	7 1/4
		Cast iron	P50910	411941-011	7/8	7 1/4
U11T	2D	Bronze	P50550	411940-041	7/8	8 3/4
		Cast iron	P50390	411940-011	7/8	8 3/4
U12T	2 1/2D	Bronze	P50930	411941-041	7/8	9 1/2
		Cast iron	P50910	411941-011	7/8	9 1/2
U13 or 14T	N/A	Bronze	P51290	419247-041	1 1/4	9 1/2
		Cast iron	P51270	419247-011	1 1/4	9 1/2

NOTES: *** For pumps built prior to 1964 (Serial no. DD) only, use only with casing part numbers: PW-121 for cast iron and PWB-121 for all bronze

ITEM 117 IMPELLER CAPSCREW

PUMP SIZE	IMPELLER BORE IN INCHES	CONSTRUCTION	PART NUMBER	
			B&G	ARMSTRONG
All sizes	7/8	BF-AB	P52320	911900-108
	7/8	AB	P52350	911900-114
	1 1/4	BF-AB	P13800	911900-113
	1 1/4	AB	P13800	911900-115

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 118 IMPELLER WASHER

PUMP SIZE	IMPELLER BORE IN INCHES	CONSTRUCTION	PART NUMBER	
			B&G	ARMSTRONG
All sizes	7/8	BF-AI	P46390	406614-000
	7/8	AB	P46380	406677-000
	1 1/4	BF-AI	P51250	425742-003
	1 1/4	AB	P51230	425742-003

ITEM 100 BEARING FRAME ASSEMBLY

PART NUMBER			SEAL SIZE	CONSTRUCTION		STYLE
B&G		ARMSTRONG		B&G	ARMSTRONG	
OLD	NEW					
(B&G MODEL 1510B — ARMSTRONG MODEL 4030)						
P77075	185011	819359-002	1 1/4"	BF	BF-AI	BALL BRG.
P77222	185012	819359-002	1 1/4"	AI	BF-AI	BALL BRG.
P77226	185013	819360-002	1 1/4"	AB&BFS	AB	BALL BRG.
P77074	185014	819310-071	1 5/8"	BF	BF-AI-AB	BALL BRG.
P77228	185015	819310-071	1 5/8"	AI	BF-AI-AB	BALL BRG.
(B&G MODEL UNIVERSAL — ARMSTRONG MODEL 4020)						
P14770	186660	806617-000	1 1/4"	BF	BF-AI-AB	SLEEVE BRG.

ITEM 208 MECHANICAL SEAL ASSEMBLY

PART NUMBER			SEAL SIZE	CONSTRUCTION	
B&G		ARMSTRONG		B&G	ARMSTRONG
OLD	NEW				
#1 KIT	186862	825458-001	1 1/4"	BF - AB	BF-AB- AI
#4 KIT	186860	825458-001	1 1/4"	AI	BF-AB- AI
#8 KIT	186543	811339-000	1 5/8"	BF - AB	BF - AB
#9 KIT	186544	811866-000	1 5/8"	AI	AI

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 201 VOLUTE COVERPLATE

PUMP SIZE		SEAL SIZE	MATERIAL	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
1¼A to 4AB	1¼D to 4D	1¼"	Cast iron	186482	409564-011
1¼A to 4AB	1¼D to 4D	1¼"	Bronze	P56779	409564-041
1¼BB to 5BB	1¼E to 5E	1¼"	Cast iron	186495	409563-011
1¼BB to 5BB	1¼E to 5E	1¼"	Bronze	P56799	409563-041
3A to 4AB	2D to 4D	1½"	Cast iron	P49940	414498-011
3A to 4AB	2D to 4D	1½"	Bronze	P49960	414498-041
1¼BB to 6BB	1¼E to 6E	1½"	Cast iron	P51540	411896-011
1¼BB to 6BB	1¼E to 6E	1½"	Bronze	P51560	411896-041
2C to 8C	2G to 8G	1½"	Cast iron	P50670	419467-011

ITEM 103 VOLUTE GASKET

PUMP SIZE		SEAL SIZE	CONSTRUCTION	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
1¼A to 4AB	1¼D to 4D	1¼" and 1½"	BF,AI,AB	P57700	106592-000
1¼BB to 5BB	1¼E to 5E		BF,AI,AB	P48690	406604-000
1¼BB to 6BB	1¼E to 6E		BF,AI,AB	P48690	406604-000
2C to 8C	2G to 8G		BF,AI,AB	P57770	419016-000

ITEM 104 VOLUTE CAPSCREW

PUMP SIZE		CONSTRUCTION	NO. REQUIRED SIZE	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
'S' SIZE 7/8" IMPELLER BORE - 1" SHAFT DIAMETER AT COUPLER					
1¼AB to 4AB	1¼D to 4D	All	8 REQUIRED ¾-16NCx1"	P40020	911121-108
1¼BB to 5BB	1¼E to 5E	All	12 REQUIRED 7/16-14NCx1"	S03980	911123-108
'M' SIZE 1¼" IMPELLER BORE - 1¼" SHAFT DIAMETER AT COUPLER					
1¼AB to 4AB	1¼D to 4D	All	8 REQUIRED ¾-16x2½"	P44250	911121-120
1¼BB to 5BB	1¼E to 5E	All	12 REQUIRED 7/16-14NCx1¼"	P03470	911123-110
2C to 8C	2G to 8G	All	12 REQUIRED ½-13NCx1½"	P13780	911125-116

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 342 WATER SLINGER

PUMP SHAFT DIAMETER	PART NUMBER	
	B&G	ARMSTRONG
1¼"	PW - 6286	406622-000
1½"	PW - 8286	419315-000

ITEM 202 COVERPLATE CAPSCREW

PUMP SIZE		CONSTRUCTION	NO. REQUIRED SIZE	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
'S' SIZE 7/8" IMPELLER BORE - 1" SHAFT DIAMETER AT COUPLER					
1¼AB to 4AB	1¼D to 4D	All	4 REQUIRED ¾-16NCx1"	P40020	911121-108
1¼BB to 5BB	1¼E to 5E				
'M' SIZE 1¼" IMPELLER BORE - 1¼" SHAFT DIAMETER AT COUPLER					
1¼AB to 4AB	1¼D to 4D	All	4 REQUIRED ¾-16x1¼"	P55420	911121-110
1¼BB to 5BB	1¼E to 5E				
2C to 8C	2G to 8G				

ITEM 401 COUPLER SELECTION TABLE (WOODS TYPE)

PUMP SHAFT SIZE	MOTOR FRAME SIZE	MOTOR SHAFT SIZE	COUPLER PART NUMBER		WOODS SIZE
			B&G	ARMSTRONG	
1"	56	5/8"	186868	819340-002	4J
1"	143T - 145T	7/8"	186869	819341-002	4J
	182 - 184				
1"	182T - 184T	1 1/8"	186870	819342-002	5J
	213 - 215				
1"	213T - 215T	1 3/8"	186871	819344-002	6J
	254U - 256U				
1"	254T - 256T	1 5/8"	186873	819347-002	7J
	284U				
1¼"	254U - 256U	1 3/8"	186872	819344-012	6J
	213T - 215T				
1¼"	254T - 256T	1 5/8"	P63239	819348-002	7J
	284U				
	284T - 286T				
1¼"	324U	1 7/8"	P63242	819349-002	8J
1¼"	324T - 326T	2 1/8"	P63245	819350-002	9E

4030 & 4020 BASE MOUNTED PUMPS

END SUCTION | PARTS CROSS REFERENCE

ITEM 407 COUPLER INSERT SELECTION TABLE (WOODS TYPE)

INSERT SIZE 'WOODS'	PART NUMBER	
	B&G	ARMSTRONG
4J	P78804	875000-801
5J	P78729	875000-802
6J	P78791	875000-803
7J	P78792	875000-804
9J	PP78796	875000-807

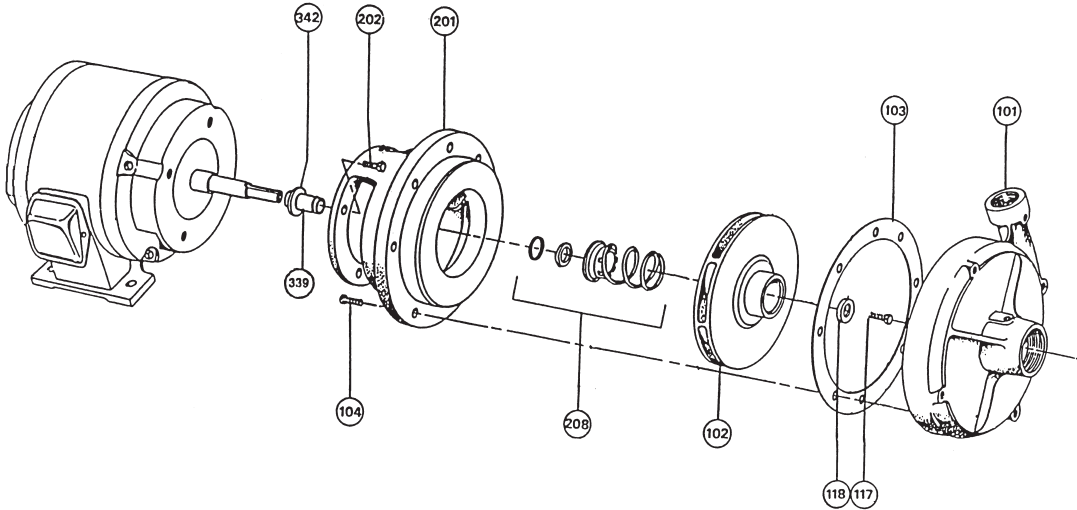
4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

MODEL NUMBER

B&G MODEL 1531

ARMSTRONG 4280 OLD STYLE, TANGENTIAL, MOTOR MOUNTED PUMPS



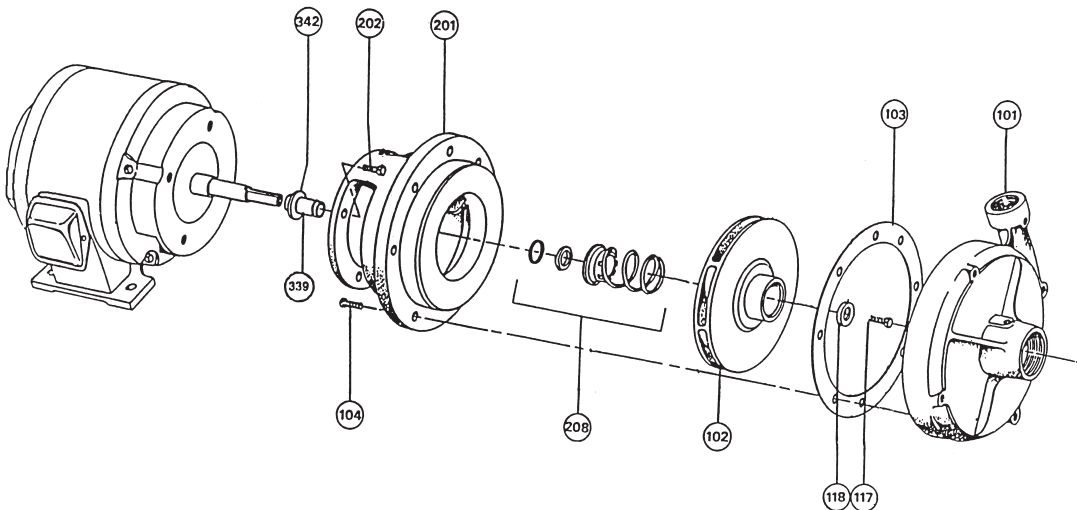
ITEM	DESCRIPTION
101	Volute
102	Impeller
103	Volute gasket
104	Volute capscrew
117	Impeller capscrew
118	Impeller washer

ITEM	DESCRIPTION
201	Volute cover plate
202	M/P bracket capscrew
208	Mechanical seal assembly
339	Shaft sleeve kit
342	Water slinger

MODEL NUMBER

B&G MODEL 1531B

ARMSTRONG MODEL, 4280 POWER FRAMES, ALL SPEEDS



4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

MODEL NUMBER

B&G MODEL 1531B | ARMSTRONG MODEL, 4280 POWER FRAMES, ALL SPEEDS

MOTOR HP AND SPEED	1800RPM	½, ¾ & 1	1½&2	3	5	7½	10	15	20	25	30	40	50
	3600RPM	1½	2&3	5	7½	10	15	20	25	30	40	50	60
FRAME SIZE	1954 RERATE	182C	184C	213C	215C	254UC	256UC	284UC	286UC	324UC	326SC		
	1964 RERATE	143JM	145JM	182JM	184JM	213JM	215JM	254JM	256JM	284JM	286JM		
	WEST COAST							254TCZ	256TCZ	284TCZ	286TCZ	324TCZ	326TCZ
	1972 RERATE							254JP	256JP	284JP	286JP	324JP	326JP
PUMP SIZE													
B&G	ARMSTRONG												
1¼AB	1¼D	S	S	S	S	S	-	-	-	-	-	-	-
1½AB	1½D	S	S	S	S	S	S	-	-	-	-	-	-
2AB	2D	S	S	S	S	S	S	-	-	-	-	-	-
2½A	2½D	S	S	S	S	S	S	M	-	-	-	-	-
3A	3D	S	S	S	-	S	S	M	M	-	-	-	-
4AB	4D	-	S	S	S	-	S	M	M	M	M	-	-
1¼BB	1¼E	-	S	S	S	-	S	M	M	M	-	-	-
1½BB	1½E	-	S	S	S	-	S	M	M	M	M	-	-
2BB	2E	-	S	S	S	S	-	M	M	M	M	M	-
2½BB	2½E	-	-	S	S	S	-	-	-	-	-	-	-
3BB	3E	-	-	-	S	S	-	-	-	-	-	-	-
4BB	4E	-	-	-	S	S	S	M	-	-	-	-	-
5BB	5E	-	-	-	-	S	S	M	M	-	-	-	-
6BB	6E	-	-	-	-	-	-	M	M	M	-	-	-

S designation - 7/8" impeller bore, 1¼" mechanical seal

M designation - 1¼" impeller bore, 1½" mechanical seal

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 101 VOLUTE

PUMP SIZE		MATERIAL	PART NUMBER	
B&G	ARMSTRONG		B&G	ARMSTRONG
1¼AB	1¼D	Cast iron	P41200**	415290-011
		Bronze	P41220**	415290-041
1½AB	1½D	Cast iron	P41690	415293-011
		Bronze	P41710	415293-041
2AB	2D	Cast iron	P42070**	425141-011
		Bronze	P42090**	425141-041
2½A	2½D	Cast iron	P42360**	425143-011
		Bronze	P42360**	425143-011
3A***	3D	Cast iron	PW-121CI**	425145-011
		Bronze	PWB-121**	425145-041
4AB	4D	Cast iron	P43250**	415299-011
		Bronze	P55280**	415299-041
1¼BB	1¼E	Cast iron	P41410**	416168-011
		Bronze	P41430**	416168-041
1½BB	1½E	Cast iron	P41780	425147-011
2BB	2E	Cast iron	P14120**	419153-011
		Bronze	P42160**	419153-041
2½B	2½E	Cast iron	P42480	415297-011
		Bronze	P55190**	415297-041
3BB	3E	Cast iron	P42740	416180-011
		Bronze	P42770	416180-041
4BB	4E	Cast iron	P43310**	415301-011
		Bronze	P55320**	415301-041
5BB	5E	Cast iron	P43620**	415303-011
		Bronze	P55360**	415303-041
6BB	6E	Cast iron	P43730**	416188-011
2C	2G	Cast iron	P42865	419544-011
		Bronze	—	419544-041
3C	3G	Cast iron	P42880	419003-011
		Bronze	—	419003-041
4C	4G	Bronze	—	419004-041
6C	6G	Cast iron	P43810	419542-011
		Bronze	—	419542-041

NOTES: ** These volutes are no longer available from B&G. 'STOCK AT ARMSTRONG'

***For pumps built prior to 1964 (serial no. DD) only, use only with impeller part numbers 411868-011 & 411868-041 (7/8" bore) and 419234-011 & 419234-041 (1¼" bore).

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 7/8" BORE

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
1¼AB	1¼D	Bronze	P46630	411852-041	7/8	7
		Cast iron	P46510	411852-011	7/8	7
1½AB	1½D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
2AB	2D	Bronze	P47950	411860-041	7/8	7
		Cast iron	P47810	411860-011	7/8	7
2½A	2½D	Bronze	P49000	406642-041	7/8	7
		Cast iron	P48770	406642-011	7/8	7
3A***	3D	Bronze	P49480	411868-041	7/8	7
		Cast iron	P49500	411868-011	7/8	7
4AB	4D	Bronze	P56140	411874-041	7/8	7
		Cast iron	P50270	411874-041	7/8	7
1¼BB	1¼E	Bronze	P78523	407922-041	7/8	9½
		Cast iron	P78253	407922-011	7/8	9½
1½BB	1½E	Bronze	P78523	407922-041	7/8	9½
		Cast iron	P78253	407922-011	7/8	9½
2BB	2E	Bronze	P78525	411881-041	7/8	9½
		Cast iron	P78486	411881-011	7/8	9½
2½B	2½E	Bronze	P78525	411881-041	7/8	9½
		Cast iron	P78486	411881-011	7/8	9½
3BB	3E	Bronze	P49620	419465-041	7/8	9½
		Cast iron	P49600	419465-011	7/8	9½
4BB	4E	Bronze	P50550	411940-041	7/8	9½
		Cast iron	P50390	411940-011	7/8	9½
5BB	5E	Bronze	P50930	411941-041	7/8	9½
		Cast iron	P50910	411941-011	7/8	9½

NOTES: *** For pumps built prior to 1964 (Serial no. DD) only, use only with casing part numbers: PW1-121CI for cast iron and PW1-121CB for all bronze

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 102 IMPELLER 1¼" BORE

PUMP SIZE		MATERIAL	PART NUMBER		IMPELLER BORE IN INCHES	MAXIMUM DIAMETER IN INCHES
B&G	ARMSTRONG		B&G	ARMSTRONG		
2½A	2½D	Bronze	P49040	419232-041	1¼	7
		Cast iron	P48980	419232-011	1¼	7
3A***	3D	Bronze	P49480	419234-041	1¼	7
		Cast iron	P49500	419234-011	1¼	7
4AB	4D	Bronze	P50310	419236-041	1¼	7
		Cast iron	P50290	419236-011	1¼	7
1¼BB	1¼E	Bronze	P78251	419238-041	1¼	9½
		Cast iron	P78522	419238-011	1¼	9½
1½BB	1½E	Bronze	P78251	419238-041	1¼	9½
		Cast iron	P78522	419238-011	1¼	9½
2BB	2E	Bronze	P78255	419239-041	1¼	9½
		Cast iron	P78257	419239-011	1¼	9½
3BB	3E	Bronze	P49640	419241-041	1¼	9½
		Cast iron	P49660	419241-011	1¼	9½
4BB	4E	Bronze	P50570	411940-041	1¼	9½
		Cast iron	P50330	411940-011	1¼	9½
5BB	5E	Bronze	P50970	419245-041	1¼	9½
		Cast iron	P50950	419245-011	1¼	9½
6BB	6E	Bronze	P51290	419247-041	1¼	9½
		Cast iron	P51270	419247-011	1¼	9½

NOTES: *** For pumps built prior to 1964 (serial no. DD) only, use only with casing part numbers: PW1-121CI for cast iron and PW1-121CB for all bronze

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 201 MOTOR/PUMP BRACKETS

PUMP SIZE		MOTOR FRAME SIZE	SEAL SIZE	CONSTRUCTION	PART NUMBER	
B&G	ARMSTRONG				B&G	ARMSTRONG
1¼AB to 4AB	1¼D to 4D	143T-145T 143JM-145JM 182-184 182JM-184JM	1¼"	BF-AI	186526	409026-012
1¼AB to 4AB	1¼D to 4D	143T-145T 143JM-145JM 182-184 182JM-184JM	1¼"	AB	P56929	409026-042
1¼AB to 4AB	1¼D to 4D	213-215 182T-184T 254U-256U 213T-215T 213JM-215JM	1¼"	BF-AI	186528	406931-012
1¼AB to 4AB	1¼D to 4D	213-215 182T-184T 254U-256U 213T-215T 213JM-215JM	1¼"	AB	P56939	406931-042
1¼BB to 5BB	1¼E to 5E	143T-145T 143JM-145JM 182-184 182JM-184JM	1¼"	BF-AI	186533	409023-012
1¼BB to 5BB	1¼E to 5E	143JM-145JM 182-184 182JM-184JM	1¼"	AB	P56969	409023-042
1¼BB to 5BB	1¼E to 5E	213-215 182T-184T 254U-256U 213T-215T 213JM-215JM	1¼"	BF-AI	186530	406948-012
1¼BB to 5BB	1¼E to 5E	213-215 182T-184T 254U-256U 213T-215T 213JM-215JM	1¼"	AB	P56949	406953-042
1¼AB to 4AB	1¼D to 4D	254T-256T 254JP-256JP	1⅝"	BF-AI	P77076	425392-012
1¼AB to 4AB	1¼D to 4D	254T-256T 254JP-256JP	1⅝"	AB	P77073	425392-042

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 201 MOTOR/PUMP BRACKETS

PUMP SIZE		MOTOR FRAME SIZE	SEAL SIZE	CONSTRUCTION	PART NUMBER	
B&G	ARMSTRONG				B&G	ARMSTRONG
1¼AB to 4AB	1¼D to 4D	284U-286U 284T-286T	1½"	BF-AI	P53690	419164-012
1¼AB to 4AB	1¼D to 4D	284U-286U 284T-286T	1½"	AB	P53710	419168-042
1¼AB to 4AB	1¼D to 4D	284JP-286JP 324U-326U 324T-326T 324JP-326JP 364T-365T 364JP-365JP 404-405	1½"	BF-AI	P53880	419165-012
1¼AB to 4AB	1¼D to 4D	284JP-286JP 324U-326U 324T-326T 324JP-326JP 364T-365T 364JP-365JP 404-405	1½"	AB	P53900	419165-042
1¼BB to 6BB	1¼E to 6E	254T-256T 254JP-256JP	1½"	BF-AI	P77166	425393-012
1¼BB to 6BB	1¼E to 6E	254T-256T 254JP-256JP	1½"	AB	P77169	425393-042
1¼BB to 6BB	1¼E to 6E	284U-286U 284T-286T	1½"	BF-AI	P53020	419166-012
1¼BB to 6BB	1¼E to 6E	284U-286U 284T-286T	1½"	AB	P53040	419170-042
1¼BB to 6BB	1¼E to 6E	284JP-286JP 324U-326U 324T-326T 324JP-326JP 364T-365T 364JP-365JP 404-405	1½"	BF-AI	P53500	411883-012
1¼BB to 6BB	1¼E to 6E	284JP-286JP 324U-326U 324T-326T 324JP-326JP 364T-365T 364JP-365JP 404-405	1½"	BF-AI	P53540	419171-042

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 117 IMPELLER CAPSCREW

MOTOR FRAME SIZE	IMPELLER BORE IN INCHES	CONSTRUCTION	PART NUMBER	
			B&G	ARMSTRONG
143T TO 215T 143JM TO 215JM 254U TO 256U	7/8	BF-AB	P52320	911900-108
143T TO 215T 143JM TO 215JM 254U TO 256U	7/8	AI	P52350	911900-114
254T TO 365T 254JP TO 365JP 284U TO 326U	1 1/4	BF-AB	P13800	911900-113
254T TO 365T 254JP TO 365JP 284U TO 326U	1 1/4	AI	P13800	911900-115

ITEM 118 IMPELLER WASHER

MOTOR FRAME SIZE	IMPELLER BORE IN INCHES	CONSTRUCTION	PART NUMBER	
			B&G	ARMSTRONG
143T TO 215T 143JM TO 215JM 254U TO 256U	7/8	BF-AI	P46930	406614-000
143T TO 215T 143JM TO 215JM 254U TO 256U	7/8	AB	P46380	406677-000
254T TO 365T 254JP TO 365JP 284U TO 326U	1 1/4	BF-AI	P51250	425742-003
254T TO 365T 254JP TO 365JP 284U TO 326U	1 1/4	AB	P51230	425742-003

ITEM 103 VOLUTE GASKET

PUMP SIZE		SEAL SIZE	CONSTRUCTION	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
1 1/4 A to 4 AB	1 1/4 D to 4 D	1 1/4 " and 1 5/8 "	BF,AI,AB	P57700	106592-000
1 1/4 BB to 5 BB	1 1/4 E to 5 E		BF,AI,AB	P48690	406604-000
3 A to 4 AB	2 D to 4 D		BF,AI,AB	P57700	106592-000
1 1/4 BB to 6 BB	1 1/4 E to 6 E		BF,AI,AB	P48690	406604-000

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 208 MECHANICAL SEAL ASSEMBLY

PART NUMBER			SEAL SIZE	CONSTRUCTION
B&G		ARMSTRONG		
OLD	NEW			
#1 KIT	186862	825458-001	1¼"	BF - AB
#4 KIT	186860	825458-001	1¼"	AI
#8 KIT	186543	811339-000	1⅝"	BF - AB
#9 KIT	186544	811866-000	1⅝"	AI

ITEM 339 SHAFT SLEEVE & SPACER KIT

MOTOR FRAME SIZE	IMPELLER BORE IN INCHES	CONSTRUCTION	PART NUMBER	
			B&G KIT	ARMSTRONG
143T TO 215T 143JM TO 215JM 254U TO 256U	1¼	BF-AB	185024	835085-001
143T TO 215T 143JM TO 215JM 254U TO 256U	1¼	AI	185025	835085-002
254T TO 365T 254JP TO 365JP 284U TO 326U	1⅝	BF-AB	185021	810150-152
254T TO 365T 254JP TO 365JP 284U TO 326U	1⅝	AI	185022	810150-153

ITEM 104 VOLUTE CAPSCREW

PUMP SIZE		CONSTRUCTION	NO. REQUIRED SIZE	PART NUMBER	
B&G	ARMSTRONG			B&G	ARMSTRONG
1¼AB to 4AB	1¼D to 4D	All	8 REQUIRED ⅜-16NCx1"	P40020	911121-108
1¼BB to 6BB	1¼E to 6E	All	12 REQUIRED 7/16-14NCx1"	P03470	911123-108

4280 MOTOR MOUNTED PUMPS

CLOSE COUPLED | PARTS CROSS REFERENCE

ITEM 202 MOTOR CAPSCREW

MOTOR FRAME SIZE	CONSTRUCTION	NUMBER REQUIRED SIZE	PART NUMBER	
			B&G	ARMSTRONG
143T-145T 143JM-145JM 182-184 182JM-184JM	All	4 REQUIRED 3/8-16NCx1 1/4"	P46930	406614-000
213C-256UC 213T-256T 213JM-215JM 254U-256U 284U-286U 284JP-286JP	All	4 REQUIRED 1/2-13NCx1 1/4"	P46380	406677-000
324UC-405UC 324JP-326JP 404-405	All	4 REQUIRED 5/8-11NCx1 1/4"	P51250	425742-003

ITEM 342 WATER SLINGER

PUMP SHAFT DIAMETER	PART NUMBER	
	B&G	ARMSTRONG
1 1/4"	PW - 6286	406622-000
1 5/8"	PW - 8286	419315-000

SHELL & TUBE HEAT EXCHANGERS

PARTS CROSS REFERENCE

PART NUMBERS

HEAT EXCHANGER		TUBE BUNDLE		SHELL GASKET	HEAD GASKET
GRAINGER	ARMSTRONG	GRAINGER	ARMSTRONG		
2P861	WS-0403-2-1	2P862	RTB WS-0403-2-1	691300-001	691301-001
2P863	WS-0404-2-1	2P864	RTB WS-0404-2-1	691300-001	691301-001
2P865	WS-0603-2-1	2P866	RTB WS-0603-2-1	691300-002	691301-002
2P867	WS-0604-2-1	2P868	RTB WS-0604-2-1	691300-002	691301-002
2P869	WS-0605-2-1	2P870	RTB WS-0605-2-1	691300-002	691301-002
2P871	WS-0804-2-1	2P872	RTB WS-0804-2-1	691300-003	691301-003

4380 & 4360 VIL PUMPS

CENTRIFUGAL CLOSE-COUPLED | PARTS CROSS REFERENCE

MODEL NUMBER	
TEEL / GRAINGER 4P934, 4P935, 4P936, 4P937, 4P938	ARMSTRONG MODEL 4380 BF

PART NUMBERS

DESCRIPTION	2×2×8	3×3×8	4×4×8	4×4×10	6×6×8
Casing	427027-011	427151-011	427053-011	427063-011	427055-011
Motor	3HP/1750/60/3/ 208/230/460- 182JM FRAME	5HP/1750/60/3/ 208/230/460- 184JM FRAME	7.5HP/1750/60/3/ 208/230/460- 213JP FRAME	10HP/1750/60/3/ 208/230/460- 215JP FRAME	15HP/1750/60/3/ 208/230/460- 254JM FRAME
Motor bracket/adaptor	426749-011	426749-011	426750-011	426754-015	426751-015
Impeller	427121-041 8" Max. od.	427129-041 8" Max. od.	427138-041 8" Max. od.	427150-041 10" Max. od.	427140-041 8" Max. od.
Seal kit	975000-991	975000-991	975000-993	975000-993	975000-993
Sleeve and spacer	810150-150	810150-150	810150-152	810150-152	810150-154
Casing gasket	426401-003	426401-003	426401-003	426401-004	426401-004
Water slinger	406622-000	406622-000	406622-000	406622-000	406622-000
Impeller washer	425742-001	425742-001	425742-003	425742-003	425742-003
Impeller capscrew	911900-114	911900-114	911900-119	911900-119	911900-119

MODEL NUMBER	
TEEL / GRAINGER 4P930, 4P931, 4P932, 4P933	ARMSTRONG 'D' SERIES 4360 BF

PART NUMBERS

DESCRIPTION	1½ D		2 D		3 D	
Casing	116397-011 c.i.	116397-041 Bronze	116174-011 c.i.	116174-041 Bronze	116646-011 c.i.	116646-041 Bronze
Impeller 7/8" bore	426993-011 Steel	426993-041 Bronze	411860-011 Steel	411860-041 Bronze	426994-041 Bronze	
Flanges	104301-011 c.i.	104301-041 Bronze	106074-011 c.i.	106074-041 Bronze	133615-011 c.i.	133615-041 Bronze
Flange gasket	104034-000		116117-000		125606-106	

4380 & 4360 VIL PUMPS

CENTRIFUGAL CLOSE-COUPLED | PARTS CROSS REFERENCE

COMMON PARTS

DESCRIPTION	PART NUMBER
Casing gasket	106592-000
Seal kit	825458-001
Sleeve and spacer	835085-001
Water slinger	406622-000
Impeller washer	425742-001
Impeller capscrew	911900-114
Adapter/Motor bracket	426991-011 (pumps built prior to serial no. 99808) 426989-011 (pumps built after serial no. 99807)
Flush line	1 ea. 997531-004 $\frac{3}{8}$ " x 12" x .032 wall copper tube 2 ea. 939001-114 $\frac{3}{8}$ " x $\frac{1}{4}$ " NPT elbow

DESIGN ENVELOPE COMPASS CIRCULATORS

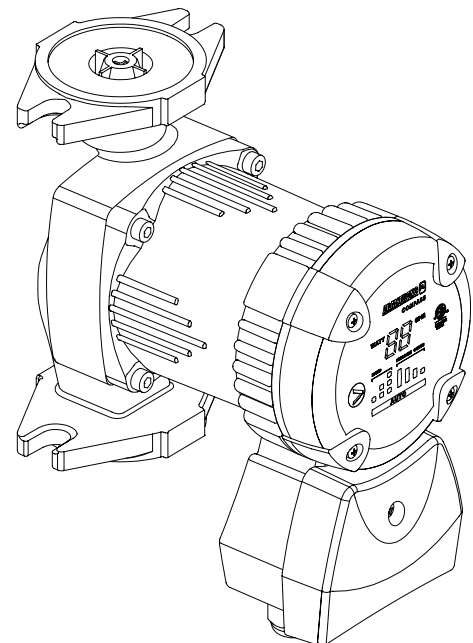
CROSS REFERENCE

MODELS	ARMSTRONG	PART NUMBER	SPEED	B & G	GRUNDFOS	WILO	TACO
Cast iron	COMPASS 20-20 CI	180203-606	vs ³	Ecocirc Auto / Vario	ALPHA 15-55F/F-LC, ALPHA 15-55FR/FR-LC ²	Stratos ECO 16F/RFC, 16FX ²	Bumble bee (HEC-2)
			1	—	UPS 15-42F S1, UPS 15-58FC S1, UP 15-10F, UPS 26-99FC S1	STAR S 16F S1	—
			2	NRF-25 S1, NRF-9F/LW ²	UPS 15-42F S2, UPS 15-58FC S2	STAR S 16F S2, STAR S 21F S1	005-F2-3-IFC ² , 006-F4/-F7-IFC, 007-F5-5/-8-IFC ² , OOR/O015-F61 IFC/ MSF2-1 IFC S1
			3	NRF-22 ² , NRF-25 S2 ¹	UP 15-42F, UPS 15-42F S3, UPS 15-58FC S3, UPS 26-99FC S1, UPS 43-44FC S1	STAR S 16F S3, STAR 16F, STAR S 21F S2 & S3	008-F6-1-IFC, OOR-F6-1-IFC, OOR/O015-MSF2-1 IFC S2 & S3
Stainless steel	COMPASS 20-20 SS	180203-607	vs ³	—	ALPHA 15-55SF/SF-LC	Stratos ECO 16BFX ²	—
			1	—	—	STAR 5 BU ¹ , STAR S 16BF S1	003-SC4-1/FC
			2	NBF/SSF-9U/LW ¹ , NBF/SSF-12U/LW ¹ , NBF/SSF-12F/LW ² , NBF-25 S1	UP 15-18BUC 5/7 ¹ , UP 15-29SU ¹ , UP 15-35SUC, UPS 15-35SUC S2 ¹ , UPS 15-35SFC S1 & S2, UP 15-18SF, UPS 15-55SFC S1 ²	STAR 8 ¹ , STAR S 16BF S2, STAR S 21BFX S1	005-BF2/-1-IFC ² , 005-SF2/-IFC ² , 006-BC4-1, 006-B7-IFC, 006-SC4-1, 006-SC7-1FC, 007-BF5/-1-IFC ² , 007-SF5/-IFC ²
			3	NBF/SSF-22 ² , NBF-25 S2 ¹	UPS 15-35SFC S3, UPS 15-55SFC S2 & S3 ² , UP 15-42SF, UP 25-64SF, UPS 26-99BFC S1, UPS 43-44BFC S1	STAR 11 BU ¹ , STAR S 16BF S3, STAR 16BF, STAR S 21BFX S2 & S3	008-BC6, 008-BC6-IFC, 008-SF6/-IFC ² , OOR/O015-SF6-IFC, OOR/O015-SF6-1-IFC ²

NOTES:

- 1 Dimension and connection may vary.
- 2 Flange orientation may vary.
- 3 Variable speed operation mode.

Compass can functionally replace fixed speed as well as variable speed products.



S&H CIRCULATORS | CROSS REFERENCE

ARMSTRONG	B&G	GRUNDFOS	TACO	PORT TO PORT LENGTH (INCHES)				MOTOR SIZE (NOMINAL HP)			
				ARMSTRONG	B&G	GRUNDFOS	TACO	ARMSTRONG	B&G	GRUNDFOS	TACO
S-25	Series 100	UP 26-64F	#110	6½	6¾	6½	6 ⁵ / ₁₆	1/12	1/12	1/12	1/12
S-35	2"	UP 50-44F	#120	8½	8½	8½	11	1/6	1/6	1/6	1/6
S-45	2½", LD3	—	#121, #122	10	10	—	11¾	¼	¼	—	¼
S-46	HD3	—	#131	10	10	—	13¾	1/3	1/3	—	1/3
S-55	PD-35	—	#132	12	12	—	13¾	1/2	1/2	—	1/2
S-57	PD-37	—	#133	12	12	—	13¾	¾	¾	—	¾
S-69	PD-38, 40	—	#138	14¼	14½	—	13¾	1	1, 1½	—	1
H-32	HV	UP 43-44	#111	8½	8½	8½	8¾	1/6	1/6	1/6	1/6
H-41	1"PR	UP 26-64F	#113	8½	8½	6½	8½	1/6	1/6	1/12	1/8
H-52	60-11	UPS 32-80	#1600	11½	11	11	10¾	¼	¼	1/2	¼
S-35	—	UPS 40-40	#1610	11½	—	13½	10¾	1/3	—	1/3	1/3
H-53	60-13	UPS 40-160	#1612	11½	11½	13½	13½	1/2	1/2	¾	1/2
H-54	60-14	UPS 50-80/2	#1632	11½	11½	11½	13½	¾	¾	¾	¾
H-63	60-15	UPS 32-160	#1612	13½	13½	13½	13½	1/2	1/2	¾	1/2
H-64	60-16	UPS 32-160	#1614	13½	13½	13½	13½	¾	¾	¾	¾
H-65	60-17	UPS 40-240	#1616	13½	13½	13½	14½	1	1	1/2	1
H-66	60-18	UPS 40-160	#1632	14	13½	11½	13½	¾	¾	¾	¾
H-67	60-19	UPS 50-160	#1634	14	14	14	13½	1	1	1/2	1
H-68	60-20	UPS 50-160	#1636	14	14	14	16½	1½	1½	1½	1½
2D 1060	60-21	UPS 50-240	—	11½	14	14	—	2	2	2	—

Connection type: Flanged

NOTE: All three-piece circulators are available in both bronze and bronze-fitted construction.

E.2 CIRCULATORS | CROSS REFERENCE

MODELS	ARMSTRONG		B&G				GRUNDFOS	TACO			
	E.2 SERIES	CONNECTION	3-PIECE	OLD 60	NEW 60	PL	WET ROTOR	3-PIECE	WET ROTOR	1400 SERIES	
OPEN SYSTEMS	E7.2B	FLANGED, 2 BOLT	1¼"	—	—	—	PL30B	UP 26-96B	—	0011	—
	E8.2B	FLANGED, 2 BOLT	1¼"	—	—	—	—	UP 26-99B	—	0013	—
	E9.2B	FLANGED, 2 BOLT	1¼"	—	—	—	PL36B	UP 26-116B	—	—	1400-20
	E10.2B	FLANGED, 2 BOLT	1½"	HV	—	—	—	UP 43-75B	—	—	—
	E11.2B	FLANGED, 2 BOLT	1½"	—	—	—	PL45B	—	—	—	1400-30
	E12.2B	FLANGED, 2 BOLT	1¼"	—	—	—	PL55B	—	—	—	1400-50
	E13.2B	FLANGED, 2 BOLT	1½"	—	—	—	PL50B	UP 43-44B	—	—	1400-40
	E14.2B	FLANGED, 2 BOLT	1¼"	—	—	—	—	—	—	—	—
	E15.2B	FLANGED, 2 BOLT	1¼"	—	—	601B	—	—	—	—	—
	E16.2B	FLANGED, 4 BOLT	2"	2	—	—	PL75B	UPS 40-40B	120	0012	1400-60
	E17.2B	FLANGED, 2 BOLT	1¼"	—	60-11B	602B	—	UPS 32-80B	—	—	—
	E19.2B	FLANGED, 2 BOLT	1½"	—	—	—	—	—	1600	—	—
	E21.2B	FLANGED, 2 BOLT	1½"	—	—	605B	—	—	1610	—	—
	E22.2B	FLANGED, 2 BOLT	1½"	—	—	622B	—	UPS 32-160B	1614	—	—
	E23.2B	FLANGED, 2 BOLT	1½"	—	60-11B	—	—	UPS 43-110B	1612	—	—
	E24.2B	FLANGED, 2 BOLT	1½"	—	60-15B	606B	—	UPS 40-80/2B	—	—	—
	E28.2B	FLANGED, 4 BOLT	3"	2½AB/LD3AB	60-13B	—	—	—	121, 122	—	—
	E29.2B	FLANGED, 4 BOLT	3"	HD3AB	—	—	—	—	131	—	—
	E30.2B	FLANGED, 4 BOLT	2"	—	—	—	PL130B-2"	—	1630	—	—
	E30.2B	FLANGED, 4 BOLT	3"	PD-35AB	—	—	PL130B-3"	—	132	—	—
E33.2B	FLANGED, 4 BOLT	2"	—	60-14B	615B	—	UPS 50-80/2B	1632	—	1400-70	
E33.2B	FLANGED, 4 BOLT	3"	—	—	—	—	—	133	—	—	
CLOSED SYSTEMS	E7.2	FLANGED, 2 BOLT	1¼"	—	—	—	PL30	UP 26-96F	—	0011	—
	E8.2	FLANGED, 2 BOLT	1¼"	—	—	—	—	UP 26-96F	—	0013	—
	E9.2	FLANGED, 2 BOLT	1¼"	—	—	—	PL36	UP 26-116F	—	—	1400-20
	E10.2	FLANGED, 2 BOLT	1½"	HV	—	—	—	UP 43-75F	112	—	—
	E11.2	FLANGED, 2 BOLT	1½"	—	—	—	PL45	—	—	—	1400-30
	E12.2	FLANGED, 2 BOLT	1¼"	—	—	—	PL55	—	—	—	1400-50
	E13.2	FLANGED, 2 BOLT	1½"	—	—	—	PL50	UP 43-44F	—	0012	1400-40
	E14.2	FLANGED, 2 BOLT	1¼"	—	—	—	—	—	—	—	—
	E15.2	FLANGED, 2 BOLT	1¼"	—	—	—	—	—	—	—	—
	E16.2	FLANGED, 4 BOLT	2"	2	—	—	PL75	UPS 40-40	120	0012	1400-60
	E17.2	FLANGED, 2 BOLT	1¼"	—	—	—	—	UPS 32-80	—	—	—
	E19.2	FLANGED, 2 BOLT	1½"	—	—	—	—	UP 43-70	1600	—	—
	E21.2	FLANGED, 2 BOLT	1½"	—	—	—	—	—	1610	—	—
	E22.2	FLANGED, 2 BOLT	1½"	—	—	—	—	UPS 32-160	1614	—	—
	E23.2	FLANGED, 2 BOLT	1½"	—	—	—	—	UP 43-110	1612	—	—
	E24.2	FLANGED, 2 BOLT	1½"	—	—	—	—	UPS 40-80/2	—	—	—
	E24.2	FLANGED, 2 BOLT	1½"	—	—	—	—	UPS 40-80/2	—	—	—
	E28.2	FLANGED, 4 BOLT	3"	2½/LD3	—	—	—	—	121, 122	—	—
	E29.2	FLANGED, 4 BOLT	3"	HD3	—	—	—	—	131	—	—
	E30.2	FLANGED, 4 BOLT	2"	—	—	—	PL130-2"	—	1630	—	—
E30.2	FLANGED, 4 BOLT	3"	PD-35	—	—	PL130-2"	—	132	—	—	
E30.2	FLANGED, 4 BOLT	3"	PD-35	—	—	PL130-2"	—	132	—	—	
E33.2	FLANGED, 4 BOLT	2"	—	—	—	—	UPS 50-80/2	1632	—	1400-70	
E33.2	FLANGED, 4 BOLT	2"	—	—	—	—	UPS 50-80/2	1632	—	1400-70	
E33.2	FLANGED, 4 BOLT	3"	—	—	—	—	—	133	—	—	

E.2 CIRCULATORS | CROSS REFERENCE

MODELS	PORT TO PORT LENGTH (INCHES)									
	E.2 SERIES	ARMSTRONG	B&G	ESP*	GRUNDFOS	ESP*	TACO	ESP*	S & H	ESP*
OPEN SYSTEMS	E7.2B	6 ³ / ₈ "	6 ³ / ₈ "	—	6 ¹ / ₂ "	—	6 ¹ / ₂ "	—	—	—
	E8.2B	6 ³ / ₈ "	—	—	6 ¹ / ₂ "	—	6 ¹ / ₂ "	—	—	—
	E9.2B	6 ³ / ₈ "	6 ³ / ₈ "	—	6 ¹ / ₂ "	—	6 ³ / ₈ "	—	—	—
	E10.2B	8 ¹ / ₂ "	8 ¹ / ₂ "	—	8 ¹ / ₂ "	—	—	—	8 ¹ / ₂ "	—
	E11.2B	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	6 ¹ / ₂ "	—	—	—
	E12.2B	6 ³ / ₈ "	6 ³ / ₈ "	—	—	—	6 ³ / ₈ "	—	—	—
	E13.2B	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	8 ¹ / ₂ "	—	—	—
	E14.2B	6 ³ / ₈ "	—	—	—	—	—	—	—	—
	E15.2B	8 ¹ / ₂ "	11"	—	—	—	—	—	11 ¹ / ₂ "	—
	E16.2B	8 ¹ / ₂ "	8 1/2"	—	13 ¹ / ₂ "	—	8 ¹ / ₂ "	—	8 ¹ / ₂ "	—
	E17.2B	8 ¹ / ₂ "	11"	—	11"	—	—	—	11 ¹ / ₂ "	—
	E19.2B	8 ¹ / ₂ "	—	—	—	—	—	—	13 ¹ / ₂ "	—
	E21.2B	8 ¹ / ₂ "	11"	—	—	—	10 ¹ / ₄ "	—	—	—
	E22.2B	8 ¹ / ₂ "	13 ¹ / ₂ "	—	11"	—	13 ¹ / ₂ "	—	—	—
	E23.2B	8 ¹ / ₂ "	13 ¹ / ₂ "	—	8 ¹ / ₂ "	—	13 ¹ / ₂ "	—	13 ¹ / ₂ "	—
	E24.2B	8 ¹ / ₂ "	11 ¹ / ₂ " / 11"	—	13 ¹ / ₂ "	—	—	—	11 ¹ / ₂ "	—
	E28.2B	8 ¹ / ₂ "	10"	—	—	—	11 ¹ / ₈ "	—	10"	—
	E29.2B	8 ¹ / ₂ "	10"	—	—	—	13 ³ / ₈ "	—	10"	—
	E30.2B	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	13 ¹ / ₂ "	—	—	—
	E30.2B	8 ¹ / ₂ "	12" / 8 ¹ / ₂ "	—	—	—	13 ³ / ₈ "	—	12"	—
E33.2B	8 ¹ / ₂ "	11 ¹ / ₂ " / 13 ¹ / ₂ "	—	14"	—	8 ¹ / ₂ "	—	11 ¹ / ₂ "	—	
E33.2B	8 ¹ / ₂ "	—	—	—	—	13 ³ / ₈ "	—	—	—	
CLOSED SYSTEMS	E7.2	6 ³ / ₈ "	6 ³ / ₈ "	—	6 ¹ / ₂ "	—	6 ¹ / ₂ "	—	—	—
	E8.2	6 ³ / ₈ "	—	—	6 ¹ / ₂ "	—	6 ¹ / ₂ "	—	—	—
	E9.2	6 ³ / ₈ "	6 ³ / ₈ "	—	6 ¹ / ₂ "	—	6 ³ / ₈ "	—	—	—
	E10.2	8 ¹ / ₂ "	8 ¹ / ₂ "	—	8 ¹ / ₂ "	—	—	—	8 ¹ / ₂ "	—
	E11.2	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	8 ¹ / ₂ "	—	—	—
	E12.2	6 ³ / ₈ "	6 ³ / ₈ "	—	—	—	6 ³ / ₈ "	—	—	—
	E13.2	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	8 ¹ / ₂ "	—	—	—
	E14.2	6 ³ / ₈ "	—	—	—	—	—	—	—	—
	E15.2	8 ¹ / ₂ "	11"	ESP-2	—	—	—	—	11 ¹ / ₂ "	ESP-1
	E16.2	8 ¹ / ₂ "	8 ¹ / ₂ "	—	13 ¹ / ₂ "	—	8 ¹ / ₂ "	—	8 ¹ / ₂ "	—
	E17.2	8 ¹ / ₂ "	11"	ESP-2	11"	ESP-2	—	—	11 ¹ / ₂ "	ESP-1
	E19.2	8 ¹ / ₂ "	11 ¹ / ₂ "	ESP-4	8 ¹ / ₂ "	—	10 ¹ / ₄ "	—	13 ¹ / ₂ "	—
	E21.2	8 ¹ / ₂ "	11"	ESP-2	—	—	10 ¹ / ₄ "	—	—	—
	E22.2	8 ¹ / ₂ "	13 ¹ / ₂ "	ESP-5	11"	ESP-11	13 ¹ / ₂ "	—	—	—
	E23.2	8 ¹ / ₂ "	13 ¹ / ₂ "	ESP-5	8 ¹ / ₂ "	—	13 ¹ / ₂ "	—	13 ¹ / ₂ "	ESP-5
	E24.2	8 ¹ / ₂ "	11 ¹ / ₂ "	ESP-4	13 ¹ / ₂ "	ESP-5	—	—	11 ¹ / ₂ "	ESP-4
	E24.2	8 ¹ / ₂ "	11"	ESP-11	13 ¹ / ₂ "	ESP-5	—	—	11 ¹ / ₂ "	ESP-4
	E28.2	8 ¹ / ₂ "	10"	ESP-6	—	—	11 ¹ / ₈ "	ESP-7	10"	ESP-6
	E29.2	8 ¹ / ₂ "	10"	ESP-6	—	—	13 ³ / ₈ "	ESP-9	10"	ESP-6
	E30.2	8 ¹ / ₂ "	8 ¹ / ₂ "	—	—	—	13 ¹ / ₂ "	—	—	—
E30.2	8 ¹ / ₂ "	12"	ESP-8	—	—	13 ³ / ₈ "	ESP-9	12"	ESP-8	
E30.2	8 ¹ / ₂ "	8 ¹ / ₂ "	ESP-8	—	—	13 ³ / ₈ "	ESP-9	12"	ESP-8	
E33.2	8 ¹ / ₂ "	11 ¹ / ₂ "	ESP-12	11 ¹ / ₂ "	ESP-12	8 ¹ / ₂ "	—	11 ¹ / ₂ "	ESP-12	
E33.2	8 ¹ / ₂ "	13 ¹ / ₂ "	ESP-10	11 ¹ / ₂ "	ESP-12	8 ¹ / ₂ "	—	11 ¹ / ₂ "	ESP-12	
E33.2	8 ¹ / ₂ "	—	—	—	—	13 ³ / ₈ "	ESP-9	—	—	

NOTE: * Use the listed spool piece models (ESP) to match E.2 series circulator port to port dimensions for a faster cleaner, pre-painted installation.

ASTRO 2 CIRCULATORS | CROSS REFERENCE

MODELS	ARMSTRONG	SPEED	B & G	GRUNDFOS	WILO	TACO
ASTRO 220SSU	1	—	—	—	—	—
	2	—	—	UP 15-10 BUC ⁵ , UP 15-10 B5 ⁴ , UP 15-10 B7 ⁵	STAR 3 BS 5 ⁴ , STAR 3 BS 7 ⁵	003-BC4-1, 003-B4-2-IFC, 003-BC4 ⁴ , 003-B4 ⁵ , 003-SC4-1/FC, 003-BC4-1-1FC ⁴ , 003-BC4-1FC ⁵
	3	—	—	UP 15-10 BUC ⁷	STAR 5 BU	—
ASTRO 225SSU	1	—	NBF-9U/LW, SSF-9U/LW, NBF-18S ⁴	UPS 15-35SUC ^(S2)	—	—
	2	—	—	UP 15-29SU	—	006-BC4-1, 006-B7-IFC, 006-SC4-1, 006-SC7-1FC
	3	—	NBF-12U/LW, SSF-12U/LW	UP 15-35SUC, UPS 15-35SUC ^(S3) , UP 15-18BUC 5/7 ¹	STAR 11 BU	—
ASTRO 230SS	1	—	—	UPS 15-35SFC ^(S2) , UP 15-18SF ²	STAR S 16BFX ^(S1)	005-BF2/-1-IFC, 005-SF2/-IFC
	2	—	NBF-12F/LW	UPS 15-35SFC ^(S2)	STAR S 16BFX ^(S2)	007-BF5/-1-IFC, 007-SF5/-IFC, 008-BC6, 008-BC6-IFC ² , 008-SF6/-IFC
	3	—	SSF-22, NBF-22	UP 15-42SF ² , UP 25-64SF ²	STAR S 16BFX ^(S3) , STAR 16BFX	00R/0015-SF6-IFC, 00R/0015-SF6-1-IFC
ASTRO 250SS	1	—	NBF-25 ^(S1)	UPS 15-55SFC ^(S1)	STAR S 21BFX ^(S1)	—
	2	—	NBF-25 ^(S2)	UPS 15-55SFC ^(S2)	STAR S 21BFX ^(S2)	—
	3	—	NBF-25 ^(S3)	UPS 15-55SFC ^(S3)	STAR S 21BFX ^(S3) , STAR 21BFX	—
ASTRO 280SS	1	—	LR-15BWR ²	UPS 26-99BFC ^(S1)	—	—
	2	—	SERIES PR B ² (8.5"), PL-30B, NBF-36 ^(S1) , NBF-45 ^(S1) , SERIES 100	UPS 26-99BFC ^(S2) , UP 26-96BF	STAR 30BU ¹	0011-BF4-4 IFC, 0011-SF4 IFC, 0011-SF4, 0014-BFI-1 IFC, 0014-SFI-IFC, 0014-SFI, 113B (8.5")
	3	—	NBF-36 ^(S2) , NBF-45 ^(S2)	UP 26-99BF, UPS 26-99BFC ^(S3)	—	0013-BF3, 0013-SF3, 0013-SF3-IFC, 1400-10B
ASTRO 280SS 230V	1	—	—	UPS 26-99BFC ^(S1)	—	—
	2	—	—	UPS 26-99BFC ^(S2) , UP 26-96BF	—	0011-BF4-4 IFC, 0011-SF4-IFC, 0011-SF4, 0014-BFI-1 IFC, 0014-SFI-IFC, 0014-SFI
	3	—	—	UP 26-99BF, UPS 26-99BFC ^(S3)	—	—
ASTRO 286SS	—	—	NBF-45 ^(S3) , PL-36B	UP 26-116BF	PL-36B	0013-BF3, 0013-SF3, 0013-SF3-IFC, 112B
ASTRO 210SS	1	—	—	—	—	—
	2	—	LR-15BWR ^(S2)	—	—	0010-BF3/SF3(-IFC)
	3	—	NBF-33	—	—	—
ASTRO 290SS	1	—	—	UPS 43-44BFC ^(S1)	—	—
	2	—	—	UPS 43-44BFC ^(S2)	—	111B ²
	3	—	SERIES HV B ²	UPS 43-44BFC ^(S3) , UP 43-44BF	TOP-Z 1.5X15 ²	0012-BF4-IFC, 0012-SF4-IFC, 111B (8.75"), 113B

STAINLESS STEEL

ASTRO 2 CIRCULATORS | CROSS REFERENCE

MODELS	ARMSTRONG	SPEED	B & G	GRUNDFOS	WILO	TACO
LEAD-FREE BRONZE	ASTRO 225BS ½" SWT	1	NBF-8S/LW	—	—	—
		2	—	—	—	—
		3	NBF-10S/LW	UP 15-18B5	STAR 8 BS 5	006-BC4, 006-BC7-1 IFC
	ASTRO 225BS ¾" SWT	1	—	—	—	—
		2	—	—	—	—
		3	—	UP 15-18B7	STAR 8 BS 7	006-B4, 006-BC7-IFC
ASTRO 230CI	1	NRF-9F/LW	UPS 15-42FR ^(S1) , UPS 15-58FRC ^(S1) , UP 15-10FR	STAR S 16FX ^(S1)	005-F2, 005-F2-2-IFC	
	2	—	UPS 15-42FR ^(S2) , UPS 15-58FRC ^(S2)	STAR S 16FX ^(S2)	007-F5/-7-IFC, 008-F6	
	3	NRF-22	UP 15-42FR, UPS 15-42FR ^(S3) , UPS 15-58FRC ^(S3)	STAR S 16FX ^(S3) , STAR 16FX	—	
ASTRO 230CI-R	1	—	UPS 15-42F ^(S1) , UPS 15-58FC ^(S1) , UP 15-10F	STAR S 16F ^(S1)	005-F2-3-IFC, 006-F4, 006-F7-IFC	
	2	—	UPS 15-42F ^(S2) , UPS 15-58FC ^(S2)	STAR S 16F ^(S2)	007-F5-5/-8-IFC, 008-F6-1-IFC, 00R/0015-F6I IFC	
	3	—	UP 15-42F, UPS 15-42F ^(S3) , UPS 15-58FC ^(S3)	STAR S 16F ^(S3) , STAR 16F	00R-F6-1-IFC	
ASTRO 250CI	1	—	—	STAR S 21FX ^(S1)	00R/0015-MSFI-IFC ^(S1)	
	2	—	—	STAR S 21FX ^(S2)	00R/0015-MSFI-IFC ^(S2)	
	3	—	—	STAR S 21FX ^(S3) , STAR 21FX	00R/0015-MSFI-IFC ^(S3)	
ASTRO 250CI-R	1	NRF-25 ^(S1)	—	STAR S 21F ^(S1)	00R/0015-MSFI-I IFC ^(S1)	
	2	NRF-25 ^(S2)	—	STAR S 21F ^(S2)	00R/0015-MSFI-I IFC ^(S2)	
	3	NRF-25 ^(S3) , NRF-36 ^(S1)	—	STAR S 21F ^(S3) , STAR 21F	00R/0015-MSFI-I IFC ^(S3)	
ASTRO 280CI	1	LR-20WR	UPS 26-99FC ^(S1)	—	—	
	2	100 ² , PL-30, PR ² (8.5"), NRF-36 ² ^(S1) , NRF-45 ² ^(S1)	UPS 26-99FC ^(S2) , UP 26-64F, UP 26-96F	STAR 30F, TOP-S 1.25x15	0011-F4-2 IFC, 0011-F4, 0014-FI-1 IFC, 0014-FI, 113 ² (8.5")	
	3	NRF-36 ² ^(S2) , NRF-45 ² ^(S2)	UP 26-99F, UPS 26-99FC ^(S3)	TOP-S 1.25x25	0013-F3, 0013-F3-1 IFC, 1400-10	
ASTRO 280CI 230V	1	—	UPS 26-99FC ^(S1)	—	—	
	2	—	UPS 26-99FC ^(S2) , UP 26-64F, UP 26-96F	TOP-S 1.25x15	0011-F4-2 IFC, 0011-F4, 0014-FI-1 IFC, 0014-FI	
	3	—	UPS 26-99FC ^(S3)	TOP-S 1.25x25	—	
ASTRO 286CI	—	NRF-45 ^{(S3)2} , PL-36	UP 26-116F	—	0013-F3, 0013-F3-1 IFC, 112 ²	
ASTRO 210CI	1	—	—	—	—	
	2	LR-20WR ²	—	—	0010-MSF1-IFC ^(S2) , 0010-F3(-IFC)	
	3	NRF-33	—	—	0010-MSF1-IFC ^(S3) , 110	
ASTRO 290CI	1	—	UPS 43-44FC ^(S1)	—	—	
	2	HV ²	UPS 43-44FC ^(S2)	—	111 ²	
	3	—	UPS 43-44FC ^(S3) , UP 43-44F	STAR 17FX ²	0012-F4-IFC, 0012-F4, 120 ² (11")	

NOTE: ¹ Dimension and connection may vary. ^(S1) Speed 1.
² Flange orientation may vary. ^(S2) Speed 2.
³ Supply voltage may vary. ^(S3) Speed 3.
⁴ Connection with ½" sweat adaptor(s).
⁵ Connection with ¾" sweat adaptor(s).

TECHNICAL DATA

PUMP FORMULAS

- Pressure (PSI)** = (Head (feet) × Specific gravity) / 2.31
- Head (feet)** = (Pressure (psi) × 2.31) / Specific gravity
- Vacuum (inches of mercury)** = Dynamic suction lift (feet) × 0.883 × Specific gravity
- Horsepower (brake)** = (GPM × Head (feet) × Specific gravity) / (3960 × Pump efficiency)
- Horsepower (water)** = (GPM × Head (feet) × Specific gravity) / 3960
- Efficiency (%)** = (Horsepower (water) × 100 percent) / Horsepower (brake)
- NPSH (available)** = Positive factors - Negative factors

AFFINITY LAWS: Effect of change of speed or Impeller diameter on centrifugal pumps.

	GPM CAPACITY	FEET HEAD	BHP
Impeller diameter change	$Q_2 = \left(\frac{D_2}{D_1}\right) Q_1$	$H_2 = \left(\frac{D_2}{D_1}\right)^2 H_1$	$P_2 = \left(\frac{D_2}{D_1}\right)^2 P_1$
Speed change	$Q_2 = \left(\frac{RPM_2}{RPM_1}\right) Q_1$	$H_2 = \left(\frac{RPM_2}{RPM_1}\right)^2 H_1$	$P_2 = \left(\frac{RPM_2}{RPM_1}\right)^2 P_1$

Where Q = GPM, Head, P = FT, D = Impeller diameter, RPM = Pump speed

NPSH (NET POSITIVE SUCTION HEAD)

NPSHR (NET POSITIVE SUCTION HEAD REQUIRED)
 NPSHR is dependent upon the pump design and is determined by the pump manufacturer. NPSHR is an important value which greatly contributes to the successful operation of a centrifugal pump. It is the amount of positive head in feed of liquid absolute required at the pump suction to prevent vaporization or cavitation of the fluid. NPSHR values usually vary with pump capacity and are based on clear water with a specific gravity of 1.0.

NPSHA (NET POSITIVE SUCTION HEAD AVAILABLE)
 NPSHA is dependent upon the system in which the pump operates. NPSHA is the amount of head or pressure that is available to prevent vaporization or cavitation of the fluid in the system. It is the amount of head available above the vapor pressure of the liquid at a specified temperature, and is measured in feet of liquid absolute.

NPSHA VS. NPSHR COMPARISON

To prevent vaporization or cavitation of the liquid in the suction side of the pump and to ensure rated pump performance, NPSHA must be greater than or equal to the NPSHR plus a two foot safety margin.

That is: $NPSHA > NPSHR + 2 \text{ feet}$

NPSHA BASIC EQUATION

$$NPSHA = \textcircled{1} + \textcircled{2} \pm \textcircled{3} - \textcircled{4} - \textcircled{5}$$

- ① Pressure on the surface of the liquid, measured on the suction side of the pump, in feet of liquid absolute (or atmospheric pressure (Patm) for open tank suction systems): $= (PSIG + Patm) \times 2.31 \div SP.GR$
- ② Velocity head in feet of liquid at the point of pressure gauge connection. Where, velocity head $= V^2 \div 64.4$; and, V is the velocity of the liquid in the pipe at the pressure gauge connection in feet per second (fps). $V = 0.32 \times GPM \div \text{area}$; Area (Sq. inches) $= d^2 \div 4$; where, diameter (d) is in inches.
- ③ Strategic height in feet of liquid that the liquid supply level is above (+) or below (-) the pump centerline.
- ④ All suction line friction losses (in feet) between the suction pressure gauge connection and the pump suction including piping, valves, and fittings.
- ⑤ Vapor pressure of the pumped liquid at the pumping temperature in feet or liquid.

TECHNICAL DATA

BAROMETRIC READINGS & ATMOSPHERIC PRESSURES CORRESPONDING TO DIFFERENT ALTITUDES

ALTITUDE		BAROMETER READING		ATMOSPHERIC PRESSURE		BOILING POINT OF WATER (°F)
FEET	METERS	IN. HG.	MM. HG.	PSIA	FT. WATER	
-1000	-304.8	31.0	788	15.2	35.2	213.8
-500	-152.4	30.5	775	15.0	34.6	212.9
0	0	29.9	760	14.7	33.9	212.0
500	152.4	29.4	747	14.4	33.3	211.1
1000	304.8	28.9	734	14.2	32.8	210.2
1500	457.2	28.3	719	13.9	32.1	209.3
2000	609.6	27.8	706	13.7	31.5	208.4
2500	762.0	27.3	694	13.4	31.0	207.4
3000	914.4	26.8	681	13.2	30.4	206.5
3500	1066.8	26.3	668	12.9	29.8	205.6
4000	1219.2	25.8	655	12.7	29.2	204.7
4500	1371.6	25.4	645	12.4	28.8	203.8
5000	1524.0	24.9	633	12.2	28.2	202.9
5500	1676.4	24.4	620	12.0	27.6	201.9
6000	1828.8	24.0	610	11.8	27.2	201.0
6500	1981.2	23.5	597	11.5	26.7	200.1
7000	2133.6	23.1	587	11.3	26.2	199.2
7500	2286.0	22.7	577	11.1	25.7	198.3
8000	2438.4	22.2	564	10.9	25.2	197.4
8500	2590.8	21.8	554	10.7	24.7	196.5
9000	2743.2	21.4	544	10.5	24.3	195.5
9500	2895.6	21.0	533	10.3	23.8	194.6
10000	3048.0	20.6	523	10.1	23.4	193.7
15000	4572.0	16.9	429	8.3	19.2	184.0

$NPSh (av) = H (atm) \pm H (s) - h (vp)$, where:

$H (atm)$ = lowest atmospheric pressure in feet absolute at system location;

$H (vp)$ = vapor pressure of liquid in feet absolute at highest liquid temperature expected.

$H (s)$ = suction pressure (+) or vacuum (-) in feet at inlet of pump.

How to obtain lowest atmospheric pressure:

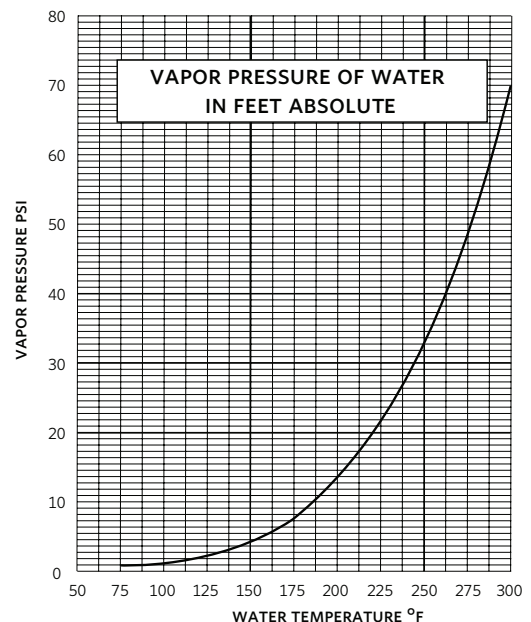
- 1 Determine average barometric pressure for location of pump. Call weather bureau. Will be given in inch of mercury.
- 2 From 1, deduct ½ inch;
- 3 Multiply 2 by 1.13 to obtain $H (atm)$

Example:

Average barometric pressure = 30.2 inches of mercury.

$H (atm) = (30.2 - 0.5) \times 1.13$

$= 29.7 \times 1.13 = 33.6$ feet



TECHNICAL DATA

FREEZING AND BOILING POINTS OF AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL

PERCENT ETHYLENE GLYCOL		FREEZING POINT (°F)	BOILING POINT (°F AT 14.6 PSIA)
BY MASS	BY VOLUME		
0	0	32	212
5	4.4	29.4	213
10	8.9	26.2	214
15	13.6	22.2	215
20	18.1	17.9	216
21	19.2	16.8	216
22	20.1	15.9	216
23	21	14.9	217
24	22	13.7	217
25	22.9	12.7	218
26	23.9	11.4	218
27	24.8	10.4	218
28	25.8	9.2	219
29	26.7	8	219
30	27.7	6.7	220
31	28.7	5.4	220
32	29.6	4.2	220
33	30.6	2.9	220
34	31.6	1.4	220
35	32.6	-0.2	221
36	33.5	-1.5	221
37	34.5	-3	221
38	35.5	-4.5	221
39	36.5	-6.4	221
40	37.5	-8.1	222
41	38.5	-9.8	222
42	39.5	-11.7	222
43	40.5	-13.5	223
44	41.5	-15.5	223
45	42.5	-17.5	224
46	43.5	-19.8	224
47	44.5	-21.6	224
48	45.5	-23.9	224
49	46.6	-26.7	224
50	47.6	-28.9	225
51	48.6	-31.2	225
52	49.6	-33.6	225
53	50.6	-36.2	226
54	51.6	-38.8	226
55	52.7	-42	227
56	53.7	-44.7	227
57	54.7	-47.5	228
58	55.7	-50	228
59	56.8	-52.7	229
60	57.8	-54.9	230
65	62.8	*	235
70	68.3	*	242
75	73.6	*	248
80	78.9	-52.2	255
85	84.3	-34.5	273
90	89.7	-21.6	285
95	95	-3	317

* Freezing points are below -60°F

FREEZING AND BOILING POINTS OF AQUEOUS SOLUTIONS OF PROPYLENE GLYCOL

PERCENT ETHYLENE GLYCOL		FREEZING POINT (°F)	BOILING POINT (°F AT 14.6 PSIA)
BY MASS	BY VOLUME		
0	0	32	212
5	4.8	29.1	212
10	9.6	26.1	212
15	14.5	22.9	212
20	19.4	19.2	213
21	20.4	18.3	213
22	21.4	17.6	213
23	22.4	16.6	213
24	23.4	15.6	213
25	24.4	14.7	214
26	25.3	13.7	214
27	26.4	12.6	214
28	27.4	11.5	215
29	28.4	10.4	215
30	29.4	9.2	216
31	30.4	7.9	216
32	31.4	6.6	216
33	32.4	5.3	216
34	33.5	3.9	216
35	34.4	2.4	217
36	35.5	0.8	217
37	36.5	-0.8	217
38	37.5	-2.4	218
39	38.5	-4.2	218
40	39.6	-6	219
41	40.6	-7.8	219
42	41.6	-9.8	219
43	42.6	-11.8	219
44	43.7	-13.9	219
45	44.7	-16.1	220
46	45.7	-18.3	220
47	46.8	-20.7	220
48	47.8	-23.1	221
49	48.9	-25.7	221
50	49.9	-28.3	222
51	50.9	-31	222
52	51.9	-33.8	222
53	53	-36.7	223
54	54	-39.7	223
55	55	-42.8	223
56	56	-46	223
57	57	-49.3	224
58	58	-52.7	224
59	59	-56.2	224
60	60	-59.9	225
65	65	*	227
70	70	*	230
75	75	*	237
80	80	*	245
85	85	*	257
90	90	*	270
95	95	*	310

* Above 60% by mass, solutions do not freeze but become a glass.

TECHNICAL DATA

DENSITY OF AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL CONCENTRATIONS IN VOLUME PERCENT ETHYLENE GLYCOL

TEMP. (°F)	10%	20%	30%	40%	50%	60%	70%	80%	90%
-30	-	-	-	-	68.12	69.03	69.9	70.75	-
-20	-	-	-	-	68.05	68.96	69.82	70.65	71.45
-10	-	-	-	67.04	64.98	68.87	69.72	70.54	71.33
0	-	-	-	66.97	67.90	68.78	69.62	70.43	71.20
10	-	-	65.93	66.89	67.80	68.67	69.50	70.3	71.06
20	-	64.83	65.85	66.8	67.70	68.56	69.38	70.16	70.92
30	63.69	67.75	65.76	66.70	67.59	68.44	69.25	70.02	70.76
40	63.61	64.66	65.66	66.59	67.47	68.31	69.10	69.86	70.59
50	63.52	64.56	65.55	66.47	67.34	68.17	68.95	69.70	70.42
60	63.42	64.45	65.43	66.34	67.20	68.02	68.79	69.53	70.23
70	63.31	64.33	65.30	66.20	67.05	67.86	68.62	69.35	70.04
80	63.19	64.21	65.17	66.05	66.90	67.69	68.44	69.15	69.83
90	63.07	64.07	65.02	65.90	66.73	67.51	68.25	68.95	69.62
100	62.93	63.93	64.86	65.73	66.55	67.32	68.05	68.74	69.40
110	62.97	63.77	64.70	65.56	66.37	67.13	67.84	68.52	69.17
120	62.63	63.61	64.52	65.37	66.17	66.92	67.63	68.29	68.92
130	62.47	63.43	64.34	65.18	65.97	66.71	67.40	68.05	68.67
140	62.30	63.25	64.15	64.98	65.75	66.48	67.16	67.81	68.41
150	62.11	63.06	63.95	64.76	65.53	66.25	66.92	67.55	68.14
160	61.92	62.86	63.73	64.54	65.30	66.00	66.66	67.28	67.86
170	61.72	62.64	63.51	64.31	65.05	65.75	66.40	67.01	67.58
180	61.51	62.42	63.28	64.07	64.80	65.49	66.12	66.72	67.28
190	61.29	62.19	63.04	63.82	64.54	65.21	65.84	66.42	66.97
200	61.06	61.95	62.79	63.56	64.27	64.93	65.55	66.12	66.65
210	60.82	61.71	62.53	63.29	63.99	64.64	65.24	65.81	66.33
220	60.57	61.45	62.27	63.01	63.70	64.36	64.93	65.48	65.99
230	60.31	61.18	61.99	62.72	63.40	64.03	64.61	65.15	65.65
240	60.05	60.90	61.70	62.43	63.10	63.71	64.28	64.81	65.29
250	59.77	60.62	61.40	62.12	62.78	63.39	63.94	64.46	64.93

NOTE: Density in lb/ft³.

TECHNICAL DATA

VISCOSITY OF AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL CONCENTRATIONS IN VOLUME PERCENT ETHYLENE GLYCOL

TEMP. (°F)	10%	20%	30%	40%	50%	60%	70%	80%	90%
-30	-	-	-	-	63.69	89.67	128.79	185.22	-
-20	-	-	-	-	40.38	60.46	89.93	131.32	284.48
-10	-	-	-	19.58	27.27	42.05	63.50	91.88	169.83
0	-	-	-	13.76	19.34	30.08	45.58	65.04	107.77
10	-	-	6.83	10.13	14.26	22.06	33.31	46.89	71.87
20	-	3.90	5.38	7.74	10.85	16.56	24.79	34.48	49.94
30	2.16	3.14	4.33	6.09	8.48	12.68	18.77	25.84	35.91
40	1.82	2.59	3.54	4.91	6.77	9.90	14.45	19.71	26.59
50	1.56	2.18	2.95	4.04	5.50	7.85	11.31	15.29	20.18
60	1.35	1.86	2.49	3.38	4.55	6.33	8.97	12.05	15.65
70	1.18	1.61	2.13	2.87	3.81	5.17	7.22	9.62	12.37
80	1.04	1.41	1.84	2.46	3.23	4.28	5.88	7.79	9.93
90	0.93	1.24	1.6	2.13	2.76	3.58	4.85	6.38	8.10
100	0.83	1.11	1.41	1.87	2.39	3.03	4.04	5.28	6.68
110	0.75	0.99	1.25	1.64	2.08	2.58	3.40	4.41	5.58
120	0.68	0.90	1.11	1.46	1.82	2.23	2.88	3.73	4.71
130	0.62	0.81	1.00	1.30	1.61	1.93	2.47	3.17	4.01
140	0.57	0.74	0.90	1.17	1.43	1.69	2.13	2.72	3.45
150	0.53	0.68	0.82	1.05	1.28	1.49	1.86	2.35	2.98
160	0.49	0.63	0.75	0.95	1.15	1.32	1.63	2.05	2.60
170	0.46	0.58	0.68	0.87	1.04	1.18	1.43	1.80	2.28
180	0.43	0.54	0.63	0.79	0.94	1.06	1.27	1.58	2.01
190	0.40	0.50	0.58	0.73	0.85	0.95	1.14	1.40	1.79
200	0.37	0.47	0.54	0.67	0.78	0.86	1.02	1.25	1.60
210	0.35	0.43	0.50	0.61	0.71	0.78	0.92	1.12	1.43
220	0.33	0.41	0.46	0.57	0.66	0.72	0.83	1.01	1.29
230	0.32	0.38	0.43	0.53	0.6	0.66	0.76	0.91	1.16
240	0.30	0.36	0.40	0.49	0.56	0.61	0.69	0.83	1.06
250	0.29	0.34	0.38	0.45	0.52	0.56	0.63	0.75	0.96

NOTE: Viscosity in centipoises. Multiply by 0.000672 for lbs./ft.-sec.

TECHNICAL DATA

DENSITY OF AQUEOUS SOLUTIONS OF PROPYLENE GLYCOL CONCENTRATIONS IN VOLUME PERCENT PROPYLENE GLYCOL

TEMP. (°F)	10%	20%	30%	40%	50%	60%	70%	80%	90%
-30	-	-	-	-	-	67.05	67.47	68.38	68.25
-20	-	-	-	-	66.46	66.93	67.34	68.13	68.00
-10	-	-	-	-	66.35	66.81	67.20	67.87	67.75
0	-	-	-	65.71	66.23	66.68	67.05	67.62	67.49
10	-	-	65.00	65.60	66.11	66.54	66.89	67.36	67.23
20	-	64.23	64.90	65.48	65.97	66.38	66.72	67.1	66.97
30	63.38	64.14	64.79	65.35	65.82	66.22	66.54	66.83	66.71
40	63.30	64.03	64.67	65.21	65.67	66.05	66.35	66.57	66.44
50	63.20	63.92	64.53	65.06	65.50	65.87	66.16	66.3	66.18
60	63.10	63.79	64.39	64.90	65.33	65.68	65.95	66.04	65.91
70	62.98	63.66	64.24	64.73	65.14	65.47	65.73	65.77	65.64
80	62.86	63.52	64.08	64.55	64.95	65.26	65.51	65.49	65.37
90	62.73	63.37	63.91	64.36	64.74	65.04	65.27	65.22	65.09
100	62.59	63.20	63.73	64.16	64.53	64.81	65.03	64.95	64.82
110	62.44	63.03	63.54	63.95	64.30	64.57	64.77	64.67	64.54
120	62.28	62.85	63.33	63.74	64.06	64.32	64.51	64.39	64.26
130	62.11	62.66	63.12	63.51	63.82	64.06	64.23	64.11	63.98
140	61.93	62.46	62.90	63.27	63.57	63.79	63.95	63.83	63.70
150	61.74	62.25	62.67	63.02	63.30	63.51	63.66	63.55	63.42
160	61.54	62.03	62.43	62.76	63.03	63.22	63.35	63.26	63.13
170	61.33	61.80	62.18	62.49	32.74	62.92	63.04	62.97	62.85
180	61.11	61.56	61.92	62.22	62.45	62.61	62.72	62.68	62.56
190	60.89	61.31	61.65	61.93	62.14	62.29	62.39	62.39	62.27
200	60.65	61.05	61.37	61.63	61.83	61.97	62.05	62.05	61.97
210	60.41	60.78	61.08	61.32	61.50	61.63	61.69	61.69	61.68
220	60.15	60.50	60.78	61.00	61.17	61.28	61.33	61.33	61.38
230	59.89	60.21	60.47	60.68	60.83	60.92	60.96	60.96	61.08
240	59.61	59.91	60.15	60.34	60.47	60.55	60.58	60.58	60.78
250	59.33	59.60	59.82	59.99	60.11	60.18	60.19	60.19	60.48

NOTE: Density in lb/ft³.

TECHNICAL DATA

VISCOSITY OF AQUEOUS SOLUTIONS OF PROPYLENE GLYCOL CONCENTRATIONS IN VOLUME PERCENT PROPYLENE GLYCOL

TEMP. (°F)	10%	20%	30%	40%	50%	60%	70%	80%	90%
-30	-	-	-	-	-	497.57	864.87	1363.75	3555.22
-20	-	-	-	-	156.08	298.75	493.93	820.58	1819.72
-10	-	-	-	-	95.97	182.96	291.28	495.68	983.05
0	-	-	-	40.99	61.32	114.90	177.73	303.94	558.32
10	-	-	13.44	27.17	40.62	74.19	112.2	190.41	332.02
20	-	5.36	9.91	18.46	27.83	49.29	73.22	122.3	205.91
30	2.80	4.23	7.47	13.2	19.66	33.68	49.32	80.66	132.67
40	2.28	3.41	5.75	9.63	14.28	23.65	34.22	54.64	88.51
50	1.89	2.79	4.52	7.22	10.65	17.05	24.41	37.99	60.93
60	1.60	2.32	3.61	5.55	8.13	12.59	17.86	27.10	43.16
70	1.38	1.95	2.94	4.36	6.34	9.51	13.38	19.79	31.37
80	1.20	1.66	2.43	3.50	5.04	7.34	10.25	14.79	23.35
90	1.05	1.43	2.04	2.86	4.08	5.77	8.00	11.29	17.75
100	0.93	1.25	1.73	2.37	3.35	4.62	6.37	8.79	13.76
110	0.83	1.10	1.49	2.00	2.79	3.76	5.15	6.97	10.86
120	0.75	0.97	1.30	1.71	2.36	3.11	4.23	5.62	8.71
130	0.68	0.87	1.14	1.49	2.02	2.61	3.53	4.60	7.09
140	0.62	0.78	1.01	1.30	1.75	2.22	2.98	3.82	5.85
150	0.57	0.71	0.90	1.16	1.53	1.91	2.54	3.22	4.89
160	0.52	0.64	0.82	1.03	1.35	1.66	2.19	2.75	4.13
170	0.48	0.59	0.74	0.93	1.20	1.45	1.91	2.37	3.52
180	0.44	0.54	0.68	0.85	1.08	1.29	1.69	2.07	3.04
190	0.41	0.50	0.62	0.78	0.97	1.15	1.50	1.82	2.64
200	0.38	0.46	0.58	0.72	0.88	1.04	1.34	1.61	2.31
210	0.36	0.43	0.54	0.67	0.81	0.94	1.21	1.45	2.04
220	0.34	0.40	0.50	0.62	0.74	0.86	1.10	1.31	1.82
230	0.32	0.38	0.47	0.59	0.69	0.79	1.00	1.19	1.63
240	0.30	0.36	0.45	0.55	0.64	0.73	0.92	1.09	1.47
250	0.28	0.34	0.42	0.52	0.59	0.68	0.85	1.00	1.33

NOTE: Viscosity in centipoises. Multiply by 0.000672 for lbs./ft.-sec.

TECHNICAL DATA

PROPERTIES OF WATER AT VARIOUS TEMPERATURES

°F	°C	SPECIFIC GRAVITY (60°F REFERENCE)	VAPOR PRESSURE (PSI)	VAPOR PRESSURE (IN FEET OF WATER COLUMN)*
32	0	1.002	0.0885	0.204
40	4.4	1.001	0.1217	0.281
45	7.2	1.001	0.1475	0.340
50	10.0	1.001	0.1781	0.411
55	12.8	1.000	0.2141	0.494
60	15.6	1.000	0.2563	0.591
65	18.3	0.999	0.3056	0.706
70	21.1	0.999	0.3631	0.839
75	23.9	0.998	0.4298	0.994
80	26.7	0.998	0.5069	1.172
85	29.4	0.997	0.5959	1.379
90	32.2	0.996	0.6982	1.617
95	35.0	0.995	0.8153	1.890
100	37.8	0.994	0.9492	2.203
110	43.3	0.992	1.2750	2.965
120	48.9	0.990	1.6920	3.943
130	54.4	0.987	2.2230	5.196
140	60.0	0.985	2.8890	6.766
150	65.6	0.982	3.7180	8.735
160	71.1	0.979	4.7410	11.172
170	76.7	0.975	5.9920	14.178
180	82.2	0.972	7.5100	17.825
190	87.8	0.968	9.3390	22.257
200	93.3	0.964	11.526	27.584
212	100.0	0.959	14.696	35.353
220	104.4	0.956	17.186	41.343
240	115.6	0.948	24.970	60.770
260	126.7	0.939	35.430	87.050
280	137.8	0.929	49.200	122.180
300	148.9	0.919	67.010	168.220
320	160.0	0.909	89.660	227.550
340	171.1	0.898	118.010	303.170
360	182.2	0.886	153.040	398.490
380	193.3	0.874	195.770	516.750
400	204.4	0.860	247.310	663.420
420	215.6	0.847	308.830	841.170
440	226.7	0.833	381.590	1056.800
460	237.8	0.818	466.900	1317.800
480	248.9	0.802	566.100	1628.400
500	260.0	0.786	680.800	1998.200

NOTE: *Vapor pressure in feet of water (absolute) converted from psia using specific gravity at temperature.

TECHNICAL DATA

FORMULAS

$$\Delta P = \frac{HD}{144}$$

Where:

ΔP = Pressure change corresponding to the head added or lost (PSI)

H = Head added or lost from the liquid (feet of head)

D = Density of the liquid at its current temperature (1LB/FT³)

$$H = \frac{144\Delta P}{D}$$

THE FLOW COEFFICIENT C_v

The C_v is defined as the flow rate of 60°F water that will create a pressure drop of 1.0 psi through the valve.

Where:

ΔP = pressure drop across the device (psi)

D = density of the fluid at its operating temperature (1LB/FT³)

62.4 = density of water at 60°F (LB/FT³)

f = flow rate of fluid through the device (gpm)

C_v = Known C_v rating of the device (gpm)

$$\Delta P = \left(\frac{D}{62.4} \right) \left(\frac{f}{C_v} \right)^2$$

USEFUL FORMULAS FOR APPLICATION OF SYSTEM CURVES

To solve for Hydraulic Resistance, R:

$$R = \frac{H_L}{f^{1.75}} \quad \text{or} \quad R = \alpha CL$$

See R-Series and R-Parallel for

Head Loss (due to Friction) H_L (ft)

$$H_L = Rf^{1.75} \quad \text{or} \quad H_L = \frac{144\Delta P}{D}$$

Where P is the pressure difference in PSI

Total head loss, H_T (ft):

H_T = Friction head + static head + discharge head*

*NOTE: For closed loop systems, static head and discharge head = 0

C value $C = \frac{R}{\alpha L}$

PRESSURE RATINGS VS. OPERATING TEMPERATURES

SOLDER	SERVICE TEMP. IN °F	MAX. ALLOWABLE WATER PRESSURE FOR (1/4" TO 1" TUBE SIZES) IN PSI	MAX. ALLOWABLE WATER PRESSURE FOR (1 1/4" TO 2" TUBE SIZES) IN PSI
50/50	100	200	175
	150	150	125
Tin/Lead	200	100	90
	250	85	75
95/5	100	500	400
	150	400	350
Tin/Antimony	200	300	250
	250	200	175

OPERATING COST

$$H = \frac{(3 \times 10^6)(D)(H_L)(f)(T)(K)}{\eta_p}$$

where:

E = annual operating cost of the piping system (\$/yr)

D = density of the fluid at its typical operating temperature (lb/ft³)

H = head loss across a device due to viscous friction (ft of head)

f = flow rate associated with the above head loss (gpm)

T = number of hours per year during which the circulator operates (hr/yr)

K = cost of electrical energy (\$/kwh)

ΔP = efficiency of the motor/pump assembly (decimal percent)

Alpha value, α :

$$\alpha = \left(\frac{R}{M} \right)^{-25}$$

See alpha value chart

Equivalent pipe length, L:

$$L = \frac{R}{\alpha C}$$

Flow, f (gpm):

$$f = \sqrt[1.75]{\frac{H_L}{R}} \quad \text{or} \quad f = \frac{Q}{500\Delta T}$$

where Q = actual BTU/hr delivered to water (IBR)

T = temperature difference on °F

TECHNICAL DATA

FORMULAS

MAXIMUM WORKING PRESSURE AT 100°F WATER FOR COPPER PIPE

NOMINAL SIZE	TYPE K	TYPE L	TYPE M
¼"	1060	900	-
⅜"	1170	800	160
½"	920	740	510
⅝"	760	650	-
¾"	880	590	420
1"	680	510	340
1¼"	550	460	340
1½"	520	430	340
2"	450	370	300
2½"	420	350	280
3"	410	330	260
3½"	380	320	260
4"	370	300	260

MAXIMUM WORKING PRESSURE AT 650°F WATER FOR STEEL PIPE

SIZE	SCHEDULE		LB/SQ.IN.
¼"	40	s	2237
	80	x	4270
⅜"	40	s	1915
	80	x	3712
½"	40	s	2233
	80	x	3817
	160		5674
		xx	11352
¾"	40	s	1891
	80	x	3227
	160		5542
		xx	9175
1"	40	s	1994
	80	x	3194
	160		5195
		xx	8647
1¼"	40	s	1406
	80	x	2424
	160		3671
		xx	6762
1½"	40	s	1307
	80	x	2260
	160		3752
		xx	6158

SIZE	SCHEDULE		LB/SQ.IN.
2"	40	s	1159
	80	x	2038
	160		3890
		xx	5356
2½"	40	s	1498
	80	x	2339
	160		3540
		xx	5878
3"	40	-s	1341
	80	-x	2129
	160		3495
		xx	5225
3½"	40	s	1248
	80	x	1999
		xx	4835
4"	40	-s	1193
	80	-x	1905
	120		2663
	160		3387
		xx	4553

TECHNICAL DATA

HYDRAULIC RESISTANCE

EQUIVALENT RESISTANCE

$$r = (\alpha c L)$$

therefore:

$$HL = r (f)^{1.75} = (\alpha c L) (f)^{1.75}$$

where:

HL = Head loss across a device due to viscous friction (ft of head)

α = fluid properties factor based on the fluid's density and viscosity

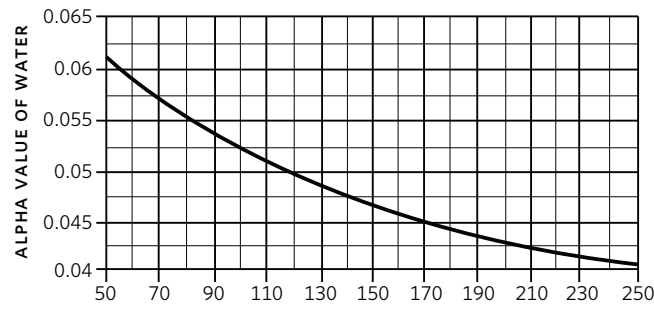
c = constant based on the size of the tube

L = length of pipe, or equivalent length of a piping device (ft)

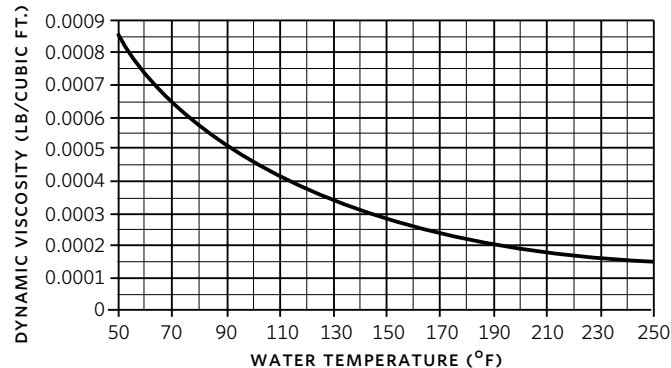
f = flow rate of fluid through the component (gpm)

Hydraulic Resistance of Series - connected Components

$$r_{\text{series}} = \sum r_i = (r_1 + r_2 + r_3 + r_4 + \dots + r_n)$$



Graph of α - value of water for temperature of 50°F to 250°F



Dynamic viscosity of water as a function of temperature

Hydraulic Resistance of Parallel - connected Components

$$r_{\text{parallel}} = \left[\left(\frac{1}{r_1} \right)^{0.5714} + \left(\frac{1}{r_2} \right)^{0.5714} + \left(\frac{1}{r_3} \right)^{0.5714} + \dots + \left(\frac{1}{r_n} \right)^{0.5714} \right]$$

THE FLUID PROPERTIES FACTOR (α)

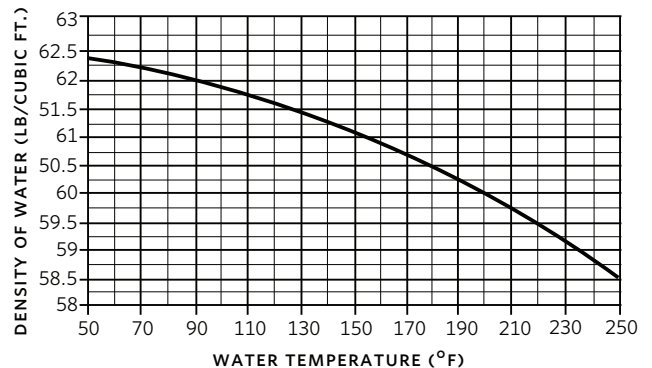
$$\alpha = \left(\frac{D}{\mu} \right)^{0.25}$$

where:

α = fluid properties factor

D = density of the fluid (1 LB/FT³)

μ = dynamic viscosity of the fluid (1LB/FT/SEC)



The density of water as a function of temperature

TECHNICAL DATA

PIPE INFORMATION SHEET - STEEL

3/8"	1/2"	5/8"	3/4"	1"
SCH 40-	SCH 40-	SCH 40-	SCH 40-	SCH 40-
OD: 0.675	OD: 0.840	OD: -	OD: 1.050	OD: 1.315
ID: 0.493	ID: 0.622	ID: -	ID: 0.824	ID: 1.049
C VALUE: 0.78765	C VALUE: 0.25984	C VALUE: -	C VALUE: 0.07471	C VALUE: 0.02436
SCH 80-	SCH 80-	SCH 80-	SCH 80-	SCH 80-
OD: 0.675	OD: 0.840	OD: -	OD: 1.050	OD: 1.315
ID: 0.423	ID: 0.546	ID: -	ID: 0.742	ID: 0.957
C VALUE: 1.70607	C VALUE: 0.48964	C VALUE: -	C VALUE: 0.12618	C VALUE: 0.03855
SCH 160-	SCH 160-	SCH 160-	SCH 160-	SCH 160-
OD: -	OD: 0.840	OD: -	OD: 1.050	OD: 1.315
ID: -	ID: 0.464	ID: -	ID: 0.614	ID: 0.815
C VALUE: -	C VALUE: 0.87174	C VALUE: -	C VALUE: 0.33293	C VALUE: 0.08658
Flow range, gpm: 0-2.8	Flow range, gpm: 0-10	Flow range, gpm:	Flow range, gpm: 0-20	Flow range, gpm: 0-45
1 1/4"	1 1/2"	2"	2 1/2"	3"
SCH 40-	SCH 40-	SCH 40-	SCH 40-	SCH 40-
OD: 1.660	OD: 1.900	OD: 2.375	OD: 2.875	OD: 3.500
ID: 1.380	ID: 1.610	ID: 2.067	ID: 2.469	ID: 3.068
C VALUE: 0.00557	C VALUE: 0.00257	C VALUE: 0.00077	C VALUE: 0.00033	C VALUE: 0.00012
SCH 80-	SCH 80-	SCH 80-	SCH 80-	SCH 80-
OD: 1.660	OD: 1.900	OD: 2.375	OD: 2.875	OD: 3.500
ID: 1.278	ID: 1.500	ID: 1.939	ID: 2.323	ID: 2.900
C VALUE: 0.00813	C VALUE: 0.00363	C VALUE: 0.00105	C VALUE: 0.00105	C VALUE: 0.00016
SCH 160-	SCH 160-	SCH 160-	SCH 160-	SCH 160-
OD: 1.660	OD: 1.900	OD: 2.375	OD: 2.875	OD: 3.500
ID: 1.160	ID: 1.338	ID: 1.689	ID: 2.125	ID: 2.626
C VALUE: 0.01316	C VALUE: 0.00635	C VALUE: 0.00206	C VALUE: 0.00069	C VALUE: 0.00026
Flow range, gpm: 0-90	Flow range, gpm: 0-180	Flow range, gpm: 0-300	Flow range, gpm: 0-500	Flow range, gpm: 0-650

TECHNICAL DATA

PIPE INFORMATION SHEET - COPPER

3/8"	1/2"	5/8"	3/4"	1"
TYPE K-	TYPE K-	TYPE K-	TYPE K-	TYPE K-
OD: 0.402	OD: 0.527	OD: 0.652	OD: 1.05	OD: 0.995
ID: 0.049	ID: 0.049	ID: 0.049	ID: 0.824	ID: 0.065
C VALUE: 1.77376	C VALUE: 0.48633	C VALUE: 0.17587	C VALUE: 0.07471	C VALUE: 0.02363
TYPE L-	TYPE L-	TYPE L-	TYPE L-	TYPE L-
OD: 0.43	OD: 0.545	OD: 0.666	OD: 1.05	OD: 1.025
ID: 0.035	ID: 0.04	ID: 0.042	ID: 0.742	ID: 0.05
C VALUE: 1.26336	C VALUE: 0.41416	C VALUE: 0.15898	C VALUE: 0.12618	C VALUE: 0.0205
TYPE M-	TYPE M-	TYPE M-	TYPE M-	TYPE M-
OD: 0.45	OD: 0.569	OD: 0.69	OD: 1.05	OD: 1.055
ID: 0.025	ID: 0.028	ID: 0.03	ID: 0.614	ID: 0.035
C VALUE: 1.03958	C VALUE: 0.3371	C VALUE: 0.12715	C VALUE: 0.33293	C VALUE: 0.01788
S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-
OD: 0.494	OD: 0.625	OD: -	OD: 1.05	OD: 1.062
ID: 0.0905	ID: 0.1075	ID: -	ID: 0.614	ID: 0.1265
C VALUE: 0.66583	C VALUE: 0.21583	C VALUE: -	C VALUE: 0.33293	C VALUE: 0.01733
Flow range, gpm: 0-5	Flow range, gpm: 0-10	Flow range, gpm: 0-13	Flow range, gpm: 0-18	Flow range, gpm: 0-50
1 1/4"	1 1/2"	2"	2 1/2"	3"
TYPE K-	TYPE K-	TYPE K-	TYPE K-	TYPE K-
OD: 1.245	OD: 1.481	OD: 1.959	OD: 2.345	OD: 2.907
ID: 0.065	ID: 0.072	ID: 0.083	ID: 0.095	ID: 0.109
C VALUE: 0.00819	C VALUE: 0.00363	C VALUE: 0.00095	C VALUE: 0.00034	C VALUE: 0.00015
TYPE L-	TYPE L-	TYPE L-	TYPE L-	TYPE L-
OD: 1.265	OD: 1.505	OD: 1.985	OD: 2.465	OD: 2.945
ID: 0.055	ID: 0.06	ID: 0.07	ID: 0.08	ID: 0.09
C VALUE: 0.00761	C VALUE: 0.00336	C VALUE: 0.00089	C VALUE: 0.00032	C VALUE: 0.00014
TYPE M-	TYPE M-	TYPE M-	TYPE M-	TYPE M-
OD: 1.219	OD: 1.527	OD: 2.009	OD: 2.495	OD: 2.981
ID: 0.042	ID: 0.049	ID: 0.058	ID: 0.065	ID: 0.072
C VALUE: 0.0069	C VALUE: 0.00313	C VALUE: 0.00084	C VALUE: 0.00031	C VALUE: 0.00013
S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-	S.P.S. PIPE-
OD: 1.368	OD: 1.6	OD: 2.062	OD: 2.5	OD: 3.062
ID: 0.146	ID: 0.15	ID: 0.1565	ID: 0.1875	ID: 0.219
C VALUE: 0.00523	C VALUE: 0.00251	C VALUE: 0.00074	C VALUE: 0.0003	C VALUE: 0.00012
Flow range, gpm: 0-100	Flow range, gpm: 0-130	Flow range, gpm: 0-300	Flow range, gpm: 0-500	Flow range, gpm: 0-800

TECHNICAL DATA

PRESSURE DROPS (PER 100FT/PIPE AT °F)

FLOW (GPM)	3/8" HEAT-PEX®				1/2" HEAT-PEX®				5/8" HEAT-PEX®				3/4" HEAT-PEX®			
	100°	120°	140°	160°	100°	120°	140°	160°	100°	120°	140°	160°	100°	120°	140°	160°
0.25	1.31	1.28	1.23	1.2	0.31	0.3	0.29	0.28	0.12	0.11	0.1	0.1	0.06	0.06	0.057	0.054
0.5	4.57	4.27	4.12	4.02	1.03	0.99	0.95	0.93	0.39	0.37	0.36	0.35	0.2	0.19	0.19	0.18
0.75	9.43	8.94	8.64	8.43	2.14	2.05	1.98	1.93	0.81	0.77	0.75	0.73	0.42	0.4	0.39	0.38
1	15.7	15.01	14.51	14.15	3.6	3.44	3.33	3.25	1.35	1.29	1.24	1.21	0.69	0.66	0.64	0.62
1.25	23.33	22.3	21.56	20.04	5.37	5.14	4.96	4.84	2.01	1.92	1.86	1.81	1.04	0.99	0.96	0.93
1.5	32.2	30.8	29.77	29.05	7.43	7.1	6.86	6.69	2.78	2.66	2.57	2.5	-	-	-	-
1.75	42.57	40.61	39.26	38.31	9.82	9.34	9.07	8.85	3.67	3.51	3.39	3.31	1.89	1.81	1.74	1.7

FRICITION OF WATER (SMOOTH WALL COPPER TUBING, BRASS, AND PLASTIC PIPE)

3/8 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	.402" INSIDE DIAMETER .049" WALL THICKNESS		.430" INSIDE DIAMETER .035" WALL THICKNESS		.450" INSIDE DIAMETER .025" WALL THICKNESS		.494" INSIDE DIAMETER .0905" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
0.2	0.51	0.55	0.44	0.48	0.4	0.39	0.34	0.26
0.4	1.01	2.15	0.88	1.57	0.81	1.27	0.67	0.82
0.6	1.52	4.29	1.33	3.12	1.21	2.52	1	1.63
0.8	2.02	7.02	1.77	5.11	1.61	4.12	1.34	2.66
1	2.52	10.32	2.2	7.5	2.01	6.05	1.68	3.89
1.5	3.78	20.66	3.3	15.5	3.02	12.21	2.51	7.84
2	5.04	34.48	4.4	20.03	4.02	20.16	3.35	12.94
2.5	6.3	51.03	5.5	37.01	5.03	29.8	4.19	19.11
3	7.55	70.38	6.6	51.02	6.04	41.07	5.02	26.32
3.5	8.82	92.44	7.7	66.98	7.04	53.9	5.86	34.52
4	10.1	117.1	8.8	84.85	8.05	68.26	6.7	43.7
4.5	11.4	144.4	9.9	104.6	9.05	84.11	7.53	53.82
5	12.6	174.3	11	126.1	10.05	101.4	8.36	64.87

NOTES:

*s.p.s. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

½ INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
½	0.74	0.88	0.69	0.75	0.63	0.62	0.52	0.4
1	1.47	2.87	1.38	2.45	1.26	2	1.04	1.28
1½	2.2	5.77	2.06	4.93	1.9	4.02	1.57	2.58
2	2.94	9.52	2.75	8.11	2.53	6.61	2.09	4.24
2½	3.67	14.05	3.44	11.98	3.16	9.76	2.61	6.25
3	4.4	19.34	4.12	16.48	3.79	13.42	3.13	8.59
3½	5.14	25.36	4.81	21.61	4.42	17.59	3.66	11.25
4	5.87	32.09	5.5	27.33	5.05	22.25	4.18	14.22
4½	6.61	39.51	6.19	33.65	5.68	27.39	4.7	17.5
5	7.35	47.61	6.87	40.52	6.31	32.99	5.22	21.07
6	8.81	65.79	8.25	56.02	7.59	45.57	6.26	29.09
7	10.3	86.57	9.62	73.69	8.84	59.93	7.31	38.23
8	11.8	109.9	11	93.5	10.1	76.03	8.35	48.47
9	13.2	135.6	12.4	115.4	11.4	93.82	9.4	59.79
10	14.7	163.8	13.8	139.4	12.6	113.3	10.4	72.16

¾ INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
1	0.74	0.56	0.66	0.44	0.62	0.38	0.6	0.35
2	1.47	1.84	1.33	1.44	1.24	1.23	1.21	1.16
3	2.21	3.73	1.99	2.91	1.86	2.49	1.81	2.34
4	2.94	6.16	2.65	4.81	2.48	4.12	2.42	3.86
5	3.67	9.12	3.31	7.11	3.1	6.09	3.02	5.71
6	4.41	12.57	3.98	9.8	3.72	8.39	3.62	7.86
7	5.14	16.51	4.64	12.86	4.34	11.01	4.23	10.32
8	5.88	20.91	5.3	16.28	4.96	13.94	4.83	13.07
9	6.61	25.77	5.96	20.06	5.59	17.17	5.44	16.1
10	7.35	31.08	6.62	24.19	6.2	20.7	6.04	19.41
11	8.09	36.83	7.29	28.66	6.82	24.52	6.64	22.99
12	8.83	43.01	7.95	33.47	7.44	28.63	7.25	26.84
13	9.56	49.62	8.61	38.61	8.06	33.02	7.85	30.96
14	10.3	56.66	9.27	44.07	8.68	37.69	8.45	35.33
15	11	64.11	9.94	49.86	9.3	42.64	9.05	39.97
16	11.8	71.97	10.6	55.97	9.92	47.86	9.65	44.86
17	12.5	80.24	11.25	62.39	10.55	53.35	10.25	50
18	13.2	88.92	11.92	69.13	11.17	59.1	10.85	55.4

NOTES:

*S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

1 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	.995" INSIDE DIAMETER .065" WALL THICKNESS		1.025" INSIDE DIAMETER .050" WALL THICKNESS		1.055" INSIDE DIAMETER .035" WALL THICKNESS		1.062" INSIDE DIAMETER .1265" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
2	0.82	0.47	0.78	0.41	0.73	0.36	0.72	0.35
3	1.24	0.95	1.17	0.82	1.1	0.72	1.08	0.7
4	1.65	1.56	1.56	1.35	1.47	1.18	1.45	1.14
5	2.06	2.3	1.95	2	1.83	1.74	1.81	1.69
6	2.48	3.17	2.34	2.75	2.2	2.4	2.17	2.32
7	2.89	4.15	2.72	3.6	2.56	3.14	2.53	3.04
8	3.3	5.25	3.11	4.56	2.93	3.97	2.89	3.85
9	3.71	6.47	3.5	5.61	3.3	4.89	3.25	4.74
10	4.12	7.79	3.89	6.76	3.66	5.89	3.61	5.71
12	4.95	10.76	4.67	9.33	4.4	8.13	4.34	7.88
14	5.77	14.15	5.45	12.27	5.13	10.69	5.05	10.36
16	6.6	17.94	6.22	15.56	5.86	13.55	5.78	13.13
18	7.42	22.14	7	19.2	6.6	16.72	6.5	16.2
20	8.24	26.73	7.78	23.18	7.33	20.18	7.22	19.55
25	10.3	39.87	9.74	34.56	9.16	30.09	9.03	29.15
30	12.37	55.33	11.68	47.96	11	41.74	10.84	40.43
35	14.42	73.06	13.61	63.31	12.82	55.09	12.65	53.37
40	16.5	93	15.55	80.58	14.66	70.11	14.45	67.9
45	18.55	115.1	17.5	99.72	16.5	86.75	16.25	84.2
50	20.6	139.4	19.45	120.7	18.32	105	18.05	101.7

NOTES:

*S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

1 1/4 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	1.245" INSIDE DIAMETER .065" WALL THICKNESS		1.265" INSIDE DIAMETER .055" WALL THICKNESS		1.291" INSIDE DIAMETER .042" WALL THICKNESS		1.368" INSIDE DIAMETER .146" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
5	1.31	0.79	1.28	0.74	1.22	0.67	1.09	0.51
6	1.58	1.09	1.53	1.01	1.47	0.92	1.31	0.7
7	1.84	1.43	1.79	1.32	1.71	1.2	1.53	0.91
8	2.11	1.81	2.04	1.67	1.96	1.52	1.75	1.15
9	2.37	2.22	2.3	2.06	2.2	1.87	1.96	1.42
10	2.63	2.67	2.55	2.48	2.45	2.25	2.18	1.71
12	3.16	3.69	3.06	3.42	2.93	3.1	2.62	2.35
15	3.95	5.47	3.83	5.07	3.66	4.6	3.27	3.49
20	5.26	9.13	5.1	8.46	4.89	7.67	4.36	5.81
25	6.58	13.59	6.38	12.59	6.11	11.42	5.46	8.65
30	7.9	18.83	7.65	17.44	7.33	15.82	6.55	11.98
35	9.21	24.83	8.94	23	8.55	20.86	7.65	15.79
40	10.5	31.57	10.2	29.24	9.77	26.51	8.74	20.06
45	11.8	38.03	11.5	36.15	11	32.77	9.83	24.8
50	13.2	47.2	12.8	43.71	12.2	39.63	10.9	29.98
60	15.8	65.65	15.3	60.78	14.7	55.1	13.1	41.66
70	18.4	86.82	17.9	80.38	17.1	72.86	15.3	55.07
80	21.1	110.7	20.4	102.5	19.6	92.85	17.5	70.16
90	23.7	137.25	23	127	22	115.1	19.6	86.91
100	26.3	166.3	25.5	153.9	24.4	139.4	21.8	105.3

NOTES:

*S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

1½ INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	1.481" INSIDE DIAMETER .072" WALL THICKNESS		1.505" INSIDE DIAMETER .060" WALL THICKNESS		1.527" INSIDE DIAMETER .049" WALL THICKNESS		1.600" INSIDE DIAMETER .150" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
8	1.49	0.79	1.44	0.73	1.4	0.68	1.27	0.55
9	1.67	0.97	1.62	0.9	1.57	0.84	1.43	0.67
10	1.86	1.17	1.8	1.08	1.75	1.01	1.59	0.81
12	2.23	1.61	2.16	1.49	2.1	1.39	1.91	1.12
15	2.79	2.39	2.7	2.21	2.63	2.07	2.39	1.65
20	3.72	3.98	3.6	3.68	3.5	3.44	3.19	2.75
25	4.65	5.91	4.51	5.48	4.38	5.11	3.98	4.09
30	5.58	8.19	5.41	7.58	5.25	7.07	4.78	5.65
35	6.51	10.79	6.31	9.99	6.13	9.31	5.58	7.45
40	7.44	13.7	7.21	12.68	7	11.83	6.37	9.45
45	8.37	16.93	8.11	15.67	7.88	14.61	7.16	11.68
50	9.3	20.46	9.01	18.94	8.76	17.66	7.96	14.11
60	11.2	28.42	10.8	26.3	10.5	24.53	9.56	19.59
70	13	37.55	12.6	34.74	12.3	32.4	11.2	25.87
80	14.9	47.82	14.4	44.24	14	41.25	12.8	32.93
90	16.7	59.21	16.2	54.78	15.8	51.07	14.4	40.76
100	18.6	71.7	18	66.34	17.5	61.84	15.9	49.34
110	20.5	85.29	19.8	78.9	19.3	73.55	17.5	58.67
120	22.3	99.95	21.6	92.46	21	86.18	19.1	68.74
130	24.2	115.7	23.4	107	22.8	99.73	20.7	79.53

NOTES:

*s.p.s. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

2 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	1.959" INSIDE DIAMETER .083" WALL THICKNESS		1.985" INSIDE DIAMETER .070" WALL THICKNESS		2.009" INSIDE DIAMETER .058" WALL THICKNESS		2.062" INSIDE DIAMETER .1565" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
10	1.07	0.31	1.04	0.29	1.01	0.27	0.96	0.24
12	1.28	0.43	1.24	0.4	1.21	0.38	1.15	0.33
14	1.49	0.56	1.45	0.52	1.42	0.5	1.34	0.44
16	1.7	0.71	1.66	0.66	1.62	0.63	1.53	0.55
18	1.92	0.87	1.87	0.82	1.82	0.77	1.72	0.68
20	2.13	1.05	2.07	0.98	2.02	0.93	1.92	0.82
25	2.66	1.55	2.59	1.46	2.53	1.38	2.39	1.22
30	3.19	2.15	3.11	2.01	3.03	1.9	2.87	1.68
35	3.73	2.82	3.62	2.65	3.54	2.5	3.35	2.21
40	4.26	3.58	4.14	3.36	4.05	3.17	3.83	2.8
45	4.79	4.42	4.66	4.15	4.55	3.92	4.3	3.46
50	5.32	5.43	5.17	5.01	5.05	4.73	4.8	4.17
60	6.39	7.4	6.21	6.95	6.06	6.56	5.75	5.79
70	7.45	9.76	7.25	9.16	7.07	8.65	6.7	7.63
80	8.52	12.42	8.28	11.65	8.09	11	7.65	9.7
90	9.58	15.36	9.31	14.41	9.1	13.6	8.61	12
100	10.65	18.58	10.4	17.43	10.1	16.45	9.57	14.51
110	11.71	22.07	11.4	20.71	11.1	19.55	10.5	17.24
120	12.78	25.84	12.4	24.25	12.1	22.88	11.5	20.18
130	13.85	29.88	13.4	28.04	13.1	26.45	12.5	23.33
140	14.9	34.18	14.5	32.07	14.2	30.26	13.4	26.69
150	16	38.75	15.5	36.36	15.2	34.3	14.4	30.25
160	17	43.58	16.5	40.89	16.2	38.58	15.3	34.01
170	18.1	48.67	17.6	45.66	17.2	43.08	16.3	37.98
180	19.2	54.01	18.6	50.67	18.2	47.81	17.2	42.15
190	20.2	59.61	19.6	55.92	19.2	52.76	18.2	46.51
200	21.3	65.46	20.7	61.41	20.2	57.94	19.2	51.07
210	22.4	71.57	21.7	67.14	21.2	63.34	20.1	55.83
220	23.4	77.93	22.8	73.1	22.2	68.96	21	60.78
230	24.5	84.53	23.8	79.29	23.2	74.8	22	65.93
240	25.6	91.38	24.8	85.72	24.3	80.86	23	71.26
250	26.6	98.43	25.9	92.37	25.3	87.14	23.9	76.79
260	27.7	105.8	26.9	99.26	26.3	93.63	24.9	82.51
270	28.8	113.4	27.9	106.4	27.3	100.3	25.8	88.42
280	29.8	121.3	29	113.7	28.3	107.3	26.8	94.52
290	30.9	129.3	30	121.3	29.4	114.3	27.8	100.8
300	32	137.6	31.1	129.1	30.4	121.8	28.7	107.3

NOTES:

*S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

2½ INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	2.435" INSIDE DIAMETER .095" WALL THICKNESS		2.465" INSIDE DIAMETER .080" WALL THICKNESS		2.495" INSIDE DIAMETER .065" WALL THICKNESS		2.500" INSIDE DIAMETER .1875" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
20	1.38	0.37	1.34	0.35	1.31	0.33	1.31	0.33
25	1.72	0.55	1.68	0.52	1.64	0.49	1.63	0.49
30	2.07	0.76	2.02	0.72	1.97	0.68	1.96	0.67
35	2.41	1	2.35	0.94	2.3	0.89	2.29	0.88
40	2.76	1.26	2.69	1.19	2.62	1.13	2.61	1.12
45	3.1	1.56	3.02	1.47	2.95	1.39	2.94	1.38
50	3.45	1.88	3.36	1.77	3.28	1.68	3.26	1.66
60	4.14	2.61	4.03	2.46	3.93	2.32	3.92	2.3
70	4.82	3.43	4.7	3.24	4.59	3.06	4.57	3.03
80	5.51	4.36	5.37	4.12	5.25	3.88	5.22	3.85
90	6.2	5.39	6.04	5.08	5.9	4.8	5.88	4.75
100	6.89	6.52	6.71	6.15	6.55	5.8	6.53	5.74
110	7.58	7.74	7.38	7.3	7.21	6.89	7.19	6.82
120	8.27	9.06	8.05	8.54	7.86	8.05	7.84	7.81
130	8.96	10.46	8.73	9.87	8.52	9.31	8.49	9.22
140	9.65	11.97	9.4	11.28	9.18	10.64	9.14	10.54
150	10.35	13.56	10.1	12.78	9.83	12.06	9.79	11.94
160	11	15.24	10.8	14.36	10.5	13.55	10.45	13.42
170	11.7	17.01	11.4	16.03	11.1	15.12	11.1	14.98
180	12.4	18.87	12.1	17.79	11.8	16.78	11.8	16.61
190	13.1	20.81	12.8	19.62	12.5	18.51	12.4	18.33
200	13.8	22.85	13.4	21.54	13.1	20.31	13.1	20.12
220	15.2	27.18	14.8	25.61	14.4	24.16	14.4	23.93
240	16.5	31.84	16.1	30.01	15.7	28.31	15.7	28.03
260	17.9	36.85	17.5	34.73	17.1	32.75	17	32.44
280	19.3	42.19	18.8	39.76	18.4	37.5	18.3	37.13
300	20.7	47.86	20.1	45.1	19.7	42.53	19.6	42.12
320	22.1	53.86	21.5	50.75	21	47.86	20.9	47.4
340	23.4	60.18	22.8	56.71	22.3	53.48	22.2	52.96
360	24.8	66.83	24.2	62.97	23.6	59.38	23.5	58.81
380	26.2	73.8	25.5	69.54	24.9	65.57	24.8	64.94
400	27.6	81.09	26.9	76.41	26.2	72.04	26.1	71.81
420	29	88.7	28.2	83.57	27.5	78.8	28.49	78.04
440	30.3	96.62	29.5	91.04	28.8	85.83	28.7	85
460	31.7	104.9	30.9	98.8	30.2	93.15	30	92.24
480	33.1	113.4	32.2	106.8	31.5	100.7	31.4	99.76
500	34.5	122.3	33.6	115.2	32.8	108.6	32.6	107.5

NOTES:

*s.p.s. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

3 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	2.907" INSIDE DIAMETER .109" WALL THICKNESS		2.945" INSIDE DIAMETER .090" WALL THICKNESS		2.981" INSIDE DIAMETER .072" WALL THICKNESS		3.062" INSIDE DIAMETER .2195" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
20	0.96	0.16	0.94	0.15	0.92	0.14	0.87	0.13
30	1.45	0.33	1.41	0.31	1.37	0.29	1.3	0.25
40	1.93	0.54	1.88	0.51	1.83	0.48	1.74	0.42
50	2.41	0.81	2.35	0.76	2.29	0.72	2.17	0.63
60	2.89	1.12	2.82	1.05	2.75	0.99	2.61	0.87
70	3.38	1.47	3.29	1.38	3.2	1.3	3.04	1.15
80	3.86	1.87	3.76	1.75	3.66	1.65	3.48	1.45
90	4.34	2.3	4.23	2.16	4.12	2.04	3.91	1.8
100	4.82	2.78	4.7	2.61	4.59	2.47	4.35	2.17
110	5.3	3.3	5.17	3.1	5.05	2.93	4.79	2.57
120	5.79	3.86	5.64	3.63	5.5	3.42	5.21	3.01
130	6.27	4.46	6.11	4.19	5.95	3.95	5.65	3.47
140	6.75	5.1	6.58	4.79	6.41	4.52	6.09	3.97
150	7.24	5.77	7.05	5.42	6.87	5.12	6.52	4.5
160	7.72	6.49	7.52	6.09	7.34	5.75	6.95	5.05
170	8.2	7.24	7.99	6.8	7.79	6.41	7.39	5.64
180	8.69	8.03	8.46	7.54	8.25	7.11	7.82	6.25
190	9.16	8.85	8.93	8.32	8.7	7.84	8.25	6.89
200	9.64	9.71	9.40	9.13	9.16	8.61	8.70	7.56
220	10.60	11.55	10.30	10.85	10.10	10.23	9.56	8.99
240	11.60	13.52	11.30	12.70	11.00	11.98	10.40	10.52
260	12.60	15.64	12.20	14.69	11.90	13.85	11.30	12.17
280	13.50	17.90	13.20	16.81	12.80	15.85	12.20	13.93
300	14.50	20.30	14.10	19.06	13.70	17.97	13.00	15.79
320	15.40	22.83	15.00	21.44	14.70	20.22	13.90	17.76
340	16.40	25.50	16.00	23.95	15.60	22.58	14.80	19.83
360	17.40	28.30	16.90	26.95	16.50	25.06	15.70	22.01
380	18.30	31.24	17.90	29.58	17.40	27.66	16.50	24.29
400	19.30	34.32	18.80	32.22	18.30	30.38	17.40	26.68
450	21.70	42.58	21.20	39.98	20.60	37.69	19.60	33.09
500	24.10	51.65	23.50	48.50	22.90	45.72	21.70	40.14
550	26.60	61.54	25.80	57.77	25.20	54.46	23.90	47.81
600	29.00	72.22	28.20	67.80	27.50	63.91	26.10	56.10
650	31.40	83.69	30.60	78.56	29.80	74.05	28.20	65.00
700	33.80	95.95	32.90	90.06	32.10	84.89	30.40	74.50
750	36.20	109.00	35.20	102.30	34.40	96.41	32.60	84.61
800	38.60	122.80	37.60	115.30	36.60	108.60	34.80	95.31

NOTES:

*S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

3½ INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	3.385" INSIDE DIAMETER .120" WALL THICKNESS		3.425" INSIDE DIAMETER .100" WALL THICKNESS		3.459" INSIDE DIAMETER .083" WALL THICKNESS		3.500" INSIDE DIAMETER .250" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
60	2.14	0.54	2.09	0.51	2.05	0.49	2.00	0.46
70	2.49	0.71	2.44	0.67	2.39	0.64	2.33	0.60
80	2.84	0.90	2.78	0.85	2.73	0.81	2.66	0.77
90	3.20	1.11	3.13	1.05	3.07	1.00	3.00	0.95
100	3.56	1.34	3.48	1.27	3.41	1.21	3.33	1.14
110	3.92	1.59	3.82	1.50	3.76	1.43	3.67	1.35
120	4.26	1.86	4.18	1.76	4.10	1.68	4.00	1.58
130	4.62	2.15	4.52	2.03	4.45	1.93	4.33	1.83
140	4.98	2.45	4.87	2.32	4.79	2.21	4.66	2.09
150	5.34	2.78	5.21	2.62	5.12	2.50	5.00	2.36
160	5.69	3.12	5.56	2.95	5.46	2.81	5.33	2.66
170	6.05	3.48	5.91	3.29	5.80	3.14	5.66	2.96
180	6.40	3.86	6.26	3.64	6.16	3.48	6.00	3.28
190	6.76	4.25	6.60	4.02	6.49	3.83	6.33	3.62
200	7.11	4.67	6.95	4.41	6.82	4.20	6.66	3.97
220	7.82	5.54	7.65	5.24	7.51	4.99	7.33	4.72
240	8.54	6.49	8.35	6.13	8.19	5.85	8.00	5.52
260	9.25	7.50	9.05	7.09	8.87	6.76	8.66	6.39
280	9.95	8.58	9.74	8.11	9.55	7.73	9.33	7.30
300	10.70	9.73	10.40	9.19	10.20	8.76	10.00	8.28
350	12.50	12.87	12.20	12.16	11.90	11.60	11.70	10.95
400	14.20	16.42	13.90	15.51	13.70	14.79	13.30	13.97
450	16.00	20.36	15.60	19.23	15.40	18.33	15.00	17.32
500	17.80	24.68	17.40	23.32	17.10	22.23	16.70	20.99
550	19.60	29.39	19.10	27.76	18.80	26.46	18.30	24.99
600	21.40	34.47	20.90	32.56	20.50	31.04	20.00	29.31
650	23.10	39.92	22.60	37.71	22.20	35.94	21.60	33.95
700	24.90	45.75	24.40	43.21	23.90	41.18	23.30	38.89
750	26.60	51.94	26.10	49.05	25.60	46.75	25.00	44.15
800	28.40	58.49	27.80	55.24	27.30	52.65	26.60	49.75
850	30.20	65.40	29.60	61.77	29.00	58.87	28.30	55.59
900	32.00	72.68	31.30	68.63	30.70	65.41	30.00	61.77
950	33.80	80.31	33.00	75.84	32.40	72.27	31.60	68.24
1000	35.60	88.29	34.80	83.37	34.10	79.46	33.30	75.02
1100	39.20	105.30	38.20	99.45	37.60	94.77	36.70	89.47
1200	42.60	123.70	41.80	116.80	41.00	111.30	40.00	105.10
1300	46.20	143.50	45.20	135.50	44.50	129.10	43.30	121.90
1400	49.80	164.70	48.70	155.50	47.90	148.20	46.60	139.90

NOTES:

*s.p.s. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

4 INCH								
FLOW (USGPM)	TYPE K TUBING		TYPE L TUBING		TYPE M TUBING		PIPE *	
	3.857" INSIDE DIAMETER .134" WALL THICKNESS		3.905" INSIDE DIAMETER .110" WALL THICKNESS		3.935" INSIDE DIAMETER .095" WALL THICKNESS		4.000" INSIDE DIAMETER .250" WALL THICKNESS	
	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	HEAD LOSS (FT./100FT.)
100	2.74	0.72	2.68	0.68	2.64	0.65	2.55	0.60
110	3.02	0.85	2.94	0.80	2.90	0.77	2.81	0.71
120	3.29	0.99	3.21	0.94	3.16	0.90	3.06	0.83
130	3.57	1.15	3.48	1.08	3.42	1.04	3.31	0.96
140	3.84	1.31	3.74	1.23	3.69	1.19	3.57	1.10
150	4.11	1.48	4.01	1.40	3.95	1.35	3.83	1.25
160	4.39	1.67	4.28	1.57	4.21	1.51	4.08	1.39
170	4.66	1.86	4.55	1.75	4.48	1.69	4.33	1.56
180	4.94	2.06	4.81	1.94	4.74	1.87	4.58	1.73
190	5.21	2.27	5.08	2.14	5.00	2.06	4.84	1.91
200	5.49	2.49	5.35	2.35	5.27	2.26	5.10	2.09
220	6.04	2.96	5.89	2.79	5.80	2.68	5.61	2.48
240	6.59	3.46	6.42	3.26	6.32	3.14	6.12	2.90
260	7.14	4.00	6.95	3.77	6.85	3.63	6.63	3.36
280	7.69	4.57	7.49	4.31	7.38	4.15	7.14	3.84
300	8.24	5.18	8.02	4.88	7.90	4.70	7.65	4.35
350	9.60	6.85	9.36	6.46	9.22	6.22	8.92	5.75
400	11.00	8.74	10.70	8.23	10.50	7.93	10.20	7.33
450	12.40	10.83	12.00	10.20	11.90	9.83	11.50	9.08
500	13.70	13.12	13.40	12.36	13.20	11.91	12.80	11.00
550	15.1	15.61	14.70	14.71	14.50	14.17	14.10	13.09
600	16.5	18.31	16.00	17.24	15.80	16.61	15.30	15.35
650	17.9	21.19	17.40	19.96	17.10	19.23	16.60	17.77
700	19.2	24.28	18.70	22.86	18.40	22.03	17.90	20.35
750	20.6	27.55	20.10	25.95	19.80	25.00	19.10	23.09
800	22.0	31.01	21.40	29.21	21.10	28.14	20.40	25.99
850	23.30	34.67	22.80	32.65	22.40	31.46	21.70	29.05
900	24.7	38.51	24.10	36.27	23.70	34.94	23.00	32.27
950	26.1	42.54	25.40	40.06	25.00	38.60	24.20	35.64
1000	27.4	46.76	26.80	44.03	26.40	42.42	25.50	39.17
1100	30.2	55.74	29.40	52.48	29.00	50.56	28.10	46.69
1200	32.9	65.45	32.10	61.62	31.60	59.37	30.60	54.82
1300	35.70	75.89	34.80	71.45	34.20	68.83	33.10	63.55
1400	38.40	87.05	37.40	81.95	36.90	78.95	35.70	72.89
1500	41.10	98.23	40.10	93.13	39.50	89.71	38.30	82.82
1600	43.90	111.50	42.80	105.00	42.10	101.10	40.80	93.34
1800	49.40	138.80	48.10	130.60	47.40	125.80	45.80	116.10
2000	54.90	168.90	53.50	158.90	52.70	153.10	51.00	141.30
2200	60.40	201.70	58.90	189.80	58.00	182.80	56.10	168.70

NOTES:

*s.p.s. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

FRICITION OF WATER (NEW STEEL PIPE)

½ INCH						
STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80			
.622" INSIDE DIAMETER			.546" INSIDE DIAMETER			
FLOW (USGPM)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
0.7	0.739	.008	0.74	0.96	.01	1.39
1.0	1.056	.017	1.86	1.37	.03	2.58
1.5	1.58	.039	2.82	2.06	.07	5.34
2.0	2.11	.069	4.73	2.74	.12	9.02
2.5	2.64	.108	7.10	3.43	.18	13.60
3.0	3.17	.156	9.94	4.11	.26	19.10
3.5	3.70	.212	13.20	4.80	.36	25.50
4.0	4.22	.277	17.00	5.48	.47	32.70
4.5	4.75	.351	21.10	6.17	.59	40.90
5.0	5.28	.433	25.80	6.86	.73	50.00
5.5	5.81	.524	30.90	7.54	.88	59.90
6.0	6.34	.624	36.40	8.23	1.05	70.70
6.5	6.86	.732	42.40	8.91	1.23	82.40
7.0	7.39	.849	48.80	9.60	1.43	95.00
7.5	7.92	.975	55.60	10.30	1.60	109.00
8.0	8.45	1.109	63.00	11.00	1.90	123.00
8.5	8.98	1.25	70.70	11.60	2.10	138.00
9.0	9.50	1.40	78.90	12.30	2.40	154.00
9.5	10.03	1.56	87.60	13.00	2.60	171.00
10.0	10.56	1.73	96.60	13.70	2.90	189.00

¾ INCH						
STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80			
.824" INSIDE DIAMETER			.742" INSIDE DIAMETER			
FLOW (USGPM)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
1.5	0.90	.013	0.72	1.11	.02	1.19
2.0	1.20	.023	1.19	1.48	.03	1.99
2.5	1.50	.035	1.78	1.86	.05	2.97
3.0	1.81	.051	2.47	2.23	.08	4.14
3.5	2.11	.069	3.26	2.60	.11	5.48
4.0	2.41	.090	4.16	2.97	.14	7.01
4.5	2.71	.114	5.17	3.34	.17	8.72
5.0	3.01	.141	6.28	3.71	.21	10.60
6.0	3.61	.203	8.80	4.45	.31	14.90
7.0	4.21	.276	11.70	5.20	.42	19.90
8.0	4.81	.360	15.10	5.94	.55	25.60
9.0	5.42	.456	18.80	6.68	.69	32.10
10.0	6.02	.563	23.00	7.42	.86	39.20
11.0	6.62	.681	27.60	8.17	1.04	47.00
12.0	7.22	.722	32.50	8.91	1.23	55.50
13.0	7.82	.951	37.90	9.63	1.44	64.80
14.0	8.42	1.103	43.70	10.40	1.70	74.70
16.0	9.63	1.44	56.40	11.90	2.20	96.70
18.0	10.80	1.82	70.80	13.40	2.80	121.00
20.0	12.00	2.25	86.80	14.80	3.40	149.00

TECHNICAL DATA

1 INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	1.049" INSIDE DIAMETER			.957" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
2	0.74	.009	.385	0.89	.01	.599
3	1.11	.019	.787	1.34	.03	1.19
4	1.48	.034	1.270	1.79	.05	1.99
5	1.86	.054	1.90	2.23	.08	2.99
6	2.23	.077	2.65	2.68	.11	4.17
8	2.97	.137	4.50	3.57	.20	7.11
10	3.71	.214	6.81	4.46	.31	10.80
12	4.45	.308	9.58	5.36	.45	15.20
14	5.20	.420	12.80	6.25	.61	20.40
16	5.94	.548	16.50	7.14	.79	26.30
18	6.68	.694	20.60	8.03	1.00	32.90
20	7.42	.857	25.20	8.92	1.24	40.30
22	8.17	1.036	30.30	9.82	1.50	48.40
24	8.91	1.23	35.80	10.70	1.80	57.20
26	9.65	1.45	41.70	11.60	2.10	66.80
28	10.39	1.68	48.10	12.50	2.40	77.10
30	11.10	1.93	55.00	13.40	2.80	88.20
35	13.00	2.62	74.10	15.60	3.80	119.00
40	14.80	3.43	96.10	17.90	5.00	154.00
45	16.70	4.33	121.00	20.10	6.30	194.00

1 1/4 INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	1.380" INSIDE DIAMETER			1.278" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
4	.858	.011	.35	1.00	.015	.51
5	1.073	.018	.52	1.25	.024	.75
6	1.29	.026	.72	1.50	.034	1.04
7	1.50	.035	.95	1.75	.048	1.33
8	1.72	.046	1.20	2.00	.062	1.69
10	2.15	.072	1.74	2.50	.097	2.55
12	2.57	.103	2.45	3.00	.140	3.57
14	3.00	.140	3.24	3.50	.190	4.75
16	3.43	.183	4.15	4.00	.249	6.10
18	3.86	.232	5.17	4.50	.315	7.61
20	4.29	.286	6.31	5.00	.388	9.28
25	5.36	.431	9.61	6.25	.607	14.20
30	6.44	.644	13.60	7.50	.874	20.10
35	7.51	.876	18.20	8.75	1.19	27.00
40	8.58	1.14	23.50	10.00	1.55	34.90
50	10.70	1.79	36.20	12.50	2.43	53.70
60	12.90	2.57	51.50	15.00	3.50	76.50
70	15.00	3.50	69.50	17.50	4.76	103.00
80	17.20	4.53	90.20	20.00	6.21	134.00
90	19.30	5.79	114.00	22.50	7.86	168.00

TECHNICAL DATA

1½ INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	1.610" INSIDE DIAMETER			1.500" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
4	.63	.006	.166	.73	.01	.233
5	.79	.010	.246	.91	.01	.346
6	.95	.014	.340	1.09	.02	.478
7	1.10	.019	.447	1.27	.03	.630
8	1.26	.025	.567	1.45	.03	.800
9	1.42	.031	.701	1.63	.04	.990
10	1.58	.039	.848	1.82	.05	1.20
12	1.89	.056	1.18	2.18	.07	1.61
14	2.21	.076	1.51	2.54	.10	2.14
16	2.52	.099	1.93	2.90	.13	2.74
18	2.84	.125	2.40	3.27	.17	3.41
20	3.15	.154	2.92	3.63	.20	4.15
22	3.47	.187	3.48	3.99	.25	4.96
24	3.78	.222	4.10	4.36	.30	5.84
26	4.10	.261	4.76	4.72	.35	6.80
28	4.41	.303	5.47	5.08	.40	7.82
30	4.73	.347	6.23	5.45	.46	8.91
32	5.04	.395	7.04	5.81	.52	10.10
34	5.36	.446	7.90	6.17	.59	11.30
36	5.67	.500	8.80	6.54	.66	12.60
38	5.99	.577	9.76	6.90	.74	14.00
40	6.30	.618	10.80	7.26	.82	15.40
42	6.62	.681	11.80	7.63	.90	16.90
44	6.93	.747	12.90	7.99	.99	18.50
46	7.25	.817	14.00	8.35	1.08	20.10
48	7.56	.889	15.20	8.72	1.18	21.80
50	7.88	.965	16.50	9.08	1.28	23.60
55	8.67	1.17	19.80	9.99	1.55	28.40
60	9.46	1.39	23.40	10.90	1.80	33.60
65	10.24	1.63	27.30	11.80	2.20	39.20
70	11.03	1.89	31.50	12.70	2.50	45.30
75	11.80	2.17	36.00	13.60	2.90	51.80
80	12.60	2.47	40.80	14.50	3.30	58.70
85	13.40	2.79	45.90	15.40	3.70	66.00
90	14.20	3.13	51.30	16.30	4.10	73.80
95	15.00	3.48	57.00	17.20	4.60	82.00
100	15.80	3.86	63.00	18.20	5.10	90.70
110	17.30	4.67	75.80	20.00	6.20	109.30
120	18.90	5.56	89.90	21.80	7.40	129.60
130	20.50	6.52	105.00	23.60	8.70	151.60
140	22.10	7.56	122.00	25.40	10.00	175.0
150	23.60	8.68	139.00	27.20	11.50	201.0
160	25.20	9.88	158.00	29.00	13.10	228.0
170	26.80	11.15	178.00	30.90	14.80	257.0
180	28.40	12.50	199.00	32.70	16.60	288.0

TECHNICAL DATA

2 INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	2.067" INSIDE DIAMETER			1.939" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
5	.478	.004	.074	.54	.00	.101
6	.574	.005	.102	.65	.01	.139
7	.669	.007	.134	.76	.01	.182
8	.765	.009	.170	.87	.01	.231
9	.860	.012	.209	.98	.01	.285
10	.956	.014	.252	1.09	.02	.343
12	1.15	.021	.349	1.30	.03	.476
14	1.34	.028	.461	1.52	.04	.628
16	1.53	.036	.586	1.74	.05	.800
18	1.72	.046	.725	1.96	.06	.991
20	1.91	.057	.878	2.17	.07	1.16
22	2.10	.069	1.05	2.39	.09	1.38
24	2.29	.082	1.18	2.61	.11	1.62
26	2.49	.096	1.37	2.83	.12	1.88
28	2.68	.111	1.57	3.04	.14	2.16
30	2.87	.128	1.82	3.26	.17	2.46
35	3.35	.174	2.38	3.80	.22	3.28
40	3.82	.227	3.06	4.35	.29	4.21
45	4.30	.288	3.82	4.89	.37	5.26
50	4.78	.355	4.66	5.43	.46	6.42
55	5.26	.430	5.58	5.98	.56	7.70
60	5.74	.511	6.58	6.52	.66	9.09
65	6.21	.600	7.66	7.06	.77	10.59
70	6.69	.696	8.82	7.61	.90	12.20
75	7.17	.799	10.10	8.15	1.03	13.90
80	7.65	.909	11.40	8.69	1.17	15.80
85	8.13	1.03	12.80	9.03	1.27	17.70
90	8.60	1.15	14.30	9.78	1.49	19.80
95	9.08	1.28	15.90	10.30	1.60	22.00
100	9.56	1.42	17.50	10.90	1.80	24.30
110	10.52	1.72	21.00	12.00	2.20	29.20
120	11.50	2.05	24.90	13.00	2.60	34.50
130	12.40	2.40	29.10	14.10	3.10	40.30
140	13.40	2.78	33.60	15.20	3.60	46.60
150	14.30	3.20	38.40	16.30	4.10	53.30
160	15.30	3.64	43.50	17.40	4.70	60.50
170	16.30	4.11	49.00	18.50	5.30	68.10
180	17.20	4.60	54.80	19.60	6.00	76.10
190	18.20	5.13	60.90	20.60	6.60	84.60
200	19.10	5.68	67.30	21.70	7.30	93.60
220	21.00	6.88	81.10	23.90	8.90	113.0
240	22.90	8.18	96.20	26.90	10.60	134.0
260	24.90	9.60	113.0	28.30	12.40	157.0
280	26.80	11.14	130.0	30.40	14.40	181.0
300	28.70	12.80	149.0	32.60	16.50	208.0

TECHNICAL DATA

2½ INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	2.469" INSIDE DIAMETER			2.323" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
8	.536	.005	.072	.61	.01	.097
10	.670	.007	.107	.76	.01	.144
12	.804	.010	.148	.91	.01	.199
14	.938	.014	.195	1.06	.02	.261
16	1.07	.018	.247	1.21	.02	.332
18	1.21	.023	.305	1.36	.03	.411
20	1.34	.028	.369	1.51	.04	.497
22	1.47	.034	.438	1.67	.04	.590
24	1.61	.040	.513	1.82	.05	.691
26	1.74	.047	.593	1.97	.06	0.800
28	1.88	.055	.679	2.12	.07	0.915
30	2.01	.063	.770	2.27	.08	1.00
35	2.35	.086	.99	2.65	.11	1.33
40	2.68	.112	1.26	3.03	.14	1.71
45	3.02	.141	1.57	3.41	.18	2.13
50	3.35	.174	1.91	3.79	.22	2.59
55	3.69	.211	2.28	4.16	.27	3.10
60	4.02	.251	2.69	4.54	.32	3.65
65	4.36	.295	3.13	4.92	.38	4.25
70	4.69	.342	3.60	5.30	.44	4.89
75	5.03	.393	4.10	5.68	.50	5.58
80	5.36	.447	4.64	6.05	.57	6.31
85	5.70	.504	5.20	6.43	.64	7.08
90	6.03	.565	5.80	6.81	.72	7.89
95	6.37	.630	6.43	7.19	0.80	8.76
100	6.70	.698	7.09	7.57	0.89	9.66
110	7.37	.844	8.51	8.33	1.08	11.60
120	8.04	1.00	10.10	9.08	1.28	13.70
130	8.71	1.18	11.70	9.84	1.50	16.00
140	9.38	1.37	13.50	10.60	1.70	18.50
150	10.05	1.57	15.50	11.30	2.00	21.10
160	10.70	1.79	17.50	12.10	2.30	23.90
170	11.40	2.02	19.70	12.90	2.60	26.90
180	12.10	2.26	22.00	13.60	2.90	30.10
190	12.70	2.52	24.40	14.40	3.20	33.40
200	13.40	2.79	27.00	15.10	3.50	36.90
220	14.70	3.38	32.50	16.70	4.30	44.40
240	16.10	4.02	38.50	18.20	5.10	52.70
260	17.40	4.72	45.00	19.70	6.00	61.60
280	18.80	5.47	52.30	21.20	7.00	71.20
300	20.10	6.28	59.60	22.70	8.00	81.60
350	23.50	8.55	80.60	26.50	10.90	110.0
400	26.80	11.20	105.0	30.30	14.30	144.0
450	30.20	14.20	132.0	34.10	18.10	181.0
500	33.50	17.40	163.0	37.90	22.30	223.0

TECHNICAL DATA

3 INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	3.068" INSIDE DIAMETER			2.900" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
10	.434	.003	.038	.49	.00	.050
15	.651	.007	.077	.73	.01	.101
20	.868	.012	.129	.97	.02	.169
25	1.09	.018	.192	1.21	.02	.253
30	1.30	.026	.267	1.45	.03	.351
35	1.52	.036	.353	1.70	.04	.464
40	1.74	.047	.449	1.94	.06	.592
45	1.95	.059	.557	2.18	.07	.734
50	2.17	.073	.676	2.43	.09	.860
55	2.39	.089	.776	2.67	.11	1.03
60	2.60	.105	.912	2.91	.13	1.21
65	2.82	.124	1.06	3.16	.15	1.40
70	3.04	.143	1.22	3.40	.18	1.61
75	3.25	.165	1.38	3.64	.21	1.83
80	3.47	.187	1.56	3.88	.23	2.07
85	3.69	.211	1.75	4.12	.26	2.31
90	3.91	.237	1.95	4.37	.29	2.58
95	4.12	.264	2.16	4.61	.33	2.86
100	4.34	.293	2.37	4.85	.36	3.15
110	4.77	.354	2.84	5.33	.44	3.77
120	5.21	.421	3.35	5.81	.52	4.45
130	5.64	.495	3.90	6.30	.62	5.19
140	6.08	.574	4.50	6.79	.71	5.98
150	6.51	.659	5.13	7.28	.82	6.82
160	6.94	.749	5.80	7.76	.93	7.72
180	7.81	.948	7.27	8.72	1.01	9.68
200	8.68	1.17	8.90	9.70	1.46	11.86
220	9.55	1.42	10.70	10.70	1.78	14.26
240	10.40	1.69	12.70	11.60	2.07	16.88
260	11.30	1.98	14.80	12.60	2.46	19.71
280	12.20	2.29	17.10	13.60	2.88	22.77
300	13.00	2.63	19.50	14.50	3.26	26.04
320	13.90	3.00	22.10	15.50	3.77	29.53
340	14.80	3.38	24.90	16.50	4.22	33.24
360	15.60	3.79	27.80	17.50	4.73	37.16
380	16.50	4.23	30.90	18.40	5.27	41.31
400	17.40	4.68	34.20	19.40	5.81	45.67
420	18.20	5.16	37.60	20.40	6.43	50.25
440	19.10	5.67	41.20	21.40	7.13	55.05
460	20.00	6.19	44.90	22.30	7.75	60.06
480	20.80	6.74	48.80	23.30	8.37	65.30
500	21.70	7.32	52.90	24.20	9.15	70.75
550	23.90	8.85	63.80	26.70	11.10	85.33
600	26.00	10.50	75.70	29.10	13.10	101.00
650	28.20	12.40	88.60	31.60	15.50	119.00

TECHNICAL DATA

3½ INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	3.548" INSIDE DIAMETER			3.364" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
15	.487	.004	.038	.54	.00	.050
20	.649	.007	.064	.72	.01	.083
25	.811	.010	.095	.90	.01	.123
30	.974	.015	.132	1.08	.02	.171
35	1.14	.020	.174	1.26	.02	.225
40	1.30	.026	.221	1.44	.03	.287
45	1.46	.033	.274	1.63	.04	.355
50	1.62	.041	.332	1.80	.05	.430
60	1.95	.059	.463	2.17	.07	.601
70	2.27	.080	.614	2.53	.10	.769
80	2.60	.105	.757	2.89	.13	.986
90	2.92	.133	.943	3.25	.16	1.23
100	3.25	.164	1.15	3.61	.20	1.50
110	3.57	.198	1.37	3.97	.24	1.79
120	3.89	.236	1.62	4.33	.29	2.11
130	4.22	.277	1.88	4.69	.34	2.46
140	4.54	.321	2.16	5.05	.40	2.83
150	4.87	.368	2.47	5.41	.45	3.22
160	5.19	.419	2.79	5.78	.52	3.64
170	5.52	.473	3.13	6.14	.59	4.09
180	5.84	.530	3.49	6.50	.66	4.56
190	6.17	.591	3.86	6.85	.73	5.06
200	6.49	.655	4.26	7.22	.81	5.58
220	7.14	.792	5.12	7.94	.98	6.70
240	7.79	.943	6.04	8.66	1.17	7.92
260	8.44	1.11	7.05	9.38	1.37	9.24
280	9.09	1.28	8.13	10.10	1.60	10.66
300	9.74	1.47	9.29	10.80	1.80	12.20
320	10.40	1.68	10.50	11.50	2.10	13.80
340	11.00	1.89	11.80	12.30	2.40	15.50
360	11.70	2.12	13.20	13.00	2.60	17.40
380	12.30	2.36	14.70	13.70	2.90	19.30
400	13.00	2.62	16.20	14.40	3.20	21.30
420	13.60	2.89	17.80	15.20	3.60	23.40
440	14.30	3.17	19.50	15.90	3.90	25.70
460	14.90	3.46	21.30	16.60	4.30	28.00
480	15.60	3.77	23.10	17.30	4.70	30.40
500	16.20	4.09	25.10	18.10	5.10	32.90
550	17.80	4.95	30.20	19.90	6.20	39.70
600	19.50	5.89	35.80	21.70	7.30	47.10
650	21.10	6.91	41.90	23.50	8.60	55.10
700	22.70	8.02	48.40	25.30	9.40	63.70
750	24.30	9.20	55.40	27.10	11.40	73.00
800	26.00	10.50	62.90	28.90	13.00	82.90
850	27.60	11.80	70.90	30.70	14.60	93.40

TECHNICAL DATA

4 INCH						
FLOW (USGPM)	STANDARD WEIGHT STEEL - SCH. 40			EXTRA STRONG STEEL - SCH. 80		
	4.026" INSIDE DIAMETER			3.826" INSIDE DIAMETER		
	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)	VELOCITY (FT./SEC.)	VELOCITY (HEAD FT.)	HEAD LOSS (FT./100FT.)
20	.504	.004	.035	.56	.00	.045
30	.756	.009	.072	.84	.01	.092
40	1.01	.016	.120	1.12	.02	.153
50	1.26	.025	.179	1.40	.03	.230
60	1.51	.036	.250	1.67	.04	.320
70	1.76	.048	.330	1.95	.06	.424
80	2.02	.063	.422	2.23	.08	.541
90	2.27	.080	.523	2.51	.10	.649
100	2.52	.099	.613	2.79	.12	.789
110	2.77	.119	.723	3.07	.15	.943
120	3.02	.142	.861	3.35	.17	1.11
130	3.28	.167	1.00	3.63	.20	1.29
140	3.53	.193	1.15	3.91	.24	1.48
150	3.78	.222	1.31	4.19	.27	1.69
160	4.03	.253	1.48	4.47	.31	1.91
170	4.28	.285	1.66	4.75	.35	2.14
180	4.54	.320	1.85	5.02	.39	2.38
190	4.79	.356	2.05	5.30	.44	2.64
200	5.04	.395	2.25	5.58	.48	2.91
220	5.54	.478	2.70	6.14	.59	3.49
240	6.05	.569	3.19	6.70	.70	4.13
260	6.55	.667	3.72	7.26	.82	4.81
280	7.06	.774	4.28	7.82	.95	5.54
300	7.56	.888	4.89	8.38	1.09	6.33
320	8.06	1.01	5.53	8.94	1.24	7.17
340	8.57	1.14	6.22	9.50	1.40	8.06
360	9.07	1.28	6.94	10.00	1.60	9.00
380	9.58	1.43	7.71	10.60	1.70	9.99
400	10.10	1.58	8.51	11.20	1.90	11.00
420	10.60	1.74	9.35	11.70	2.10	12.10
440	11.10	1.91	10.20	12.30	2.30	13.30
460	11.60	2.09	11.20	12.80	2.50	14.50
480	12.10	2.27	12.10	13.40	2.80	15.70
500	12.60	2.47	13.10	14.00	3.00	17.00
550	13.90	2.99	15.80	15.30	3.60	20.50
600	15.10	3.55	18.70	16.70	4.30	24.30
650	16.40	4.17	21.70	18.10	5.10	28.40
700	17.60	4.84	25.30	19.50	5.90	32.80
750	18.90	5.55	28.90	20.90	6.80	37.60
800	20.20	6.32	32.80	22.30	7.70	42.70
850	21.40	7.13	37.00	23.70	8.70	48.10
900	22.70	8.00	41.40	25.10	9.80	53.80
950	23.90	8.91	46.00	26.50	10.90	59.80
1000	25.20	9.87	50.90	27.90	12.10	66.20
1100	27.70	11.90	61.40	30.70	14.60	79.80

TECHNICAL DATA

FRICITION LOSSES THROUGH PIPE FITTINGS & VALVES

SIZE OF PIPE (INCHES)	GATE VALVE				GLOBE VALVE-WIDE OPEN	ANGLE VALVE-WIDE OPEN	CHECK VALVE-WIDE OPEN	ORDINARY ENTRANCE TO PIPE LINES	STD. 90° ELBOW	MEDIUM SWEEP 90° ELBOW	LONG SWEEP 90° ELBOW
	WIDE OPEN	¼ CLOSED	½ CLOSED	¾ CLOSED							

STRAIGHT PIPE IN FEET (EQUIVALENT LENGTH)

1/8	0.14	0.85	5.00	19.00	9.00	5.00	2.00	0.46	0.74	0.65	0.50
1/4	0.21	1.25	7.00	26.00	12.00	6.00	3.00	0.60	1.00	0.86	0.70
3/8	0.27	1.80	9.00	36.00	16.00	8.00	4.00	0.75	1.40	1.15	0.90
1/2	0.41	2.10	12.00	44.00	17.60	7.78	5.18	0.90	1.60	1.55	1.10
3/4	0.55	2.90	14.00	59.00	23.30	10.30	6.86	1.40	2.30	2.06	1.50
1	0.70	3.40	18.00	70.00	29.70	13.10	8.74	1.60	2.70	2.62	2.00
1 1/4	0.92	4.80	24.00	96.00	39.10	17.80	11.50	2.50	3.60	3.45	2.50
1 1/2	1.07	5.60	28.00	116.00	45.60	20.10	13.40	3.00	4.50	4.03	2.90
2	1.38	7.00	36.00	146.00	58.60	25.80	17.20	3.50	5.40	5.17	3.60
2 1/2	1.65	8.40	41.00	172.00	70.00	30.90	20.60	4.00	6.50	6.17	4.40
3	2.04	10.00	52.00	213.00	86.90	38.40	25.50	5.00	8.50	7.67	5.50
3 1/2	2.10	12.50	60.00	246.00	100.00	52.00	24.00	5.50	10.0	8.50	6.30
4	2.40	14.00	70.00	285.00	116.00	57.00	27.00	6.50	12.0	9.50	7.20

SIZE OF PIPE (INCHES)	45° ELBOW	SQUARE 90° ELBOW	CLOSE RETURN BENDS	STD. TEE	STD. TEE	USE THE SMALLER DIAMETER IN THE COLUMN FOR PIPE SIZE $\frac{d}{D} = \frac{\text{Smaller diameter}}{\text{Larger diameter}}$					
						ABRUPT CONTRACTION			ABRUPT ENLARGEMENT		
						$\frac{d}{D} \frac{1}{4}$	$\frac{d}{D} \frac{1}{2}$	$\frac{d}{D} \frac{3}{4}$	$\frac{d}{D} \frac{1}{4}$	$\frac{d}{D} \frac{1}{2}$	$\frac{d}{D} \frac{3}{4}$

STRAIGHT PIPE IN FEET (EQUIVALENT LENGTH)

1/8	0.40	1.60	2.00	0.50	1.60	0.40	0.30	0.16	0.74	0.46	0.16
1/4	0.50	2.30	3.00	0.70	2.30	0.50	0.40	0.22	1.00	0.62	0.22
3/8	0.65	3.00	4.00	0.90	3.00	0.65	0.50	0.29	1.40	0.83	0.29
1/2	0.83	4.00	5.00	1.00	3.10	0.80	0.60	0.36	1.60	1.20	0.36
3/4	1.10	5.00	6.00	1.40	4.10	1.00	0.80	0.48	2.30	1.40	0.48
1	1.40	6.00	7.00	1.80	5.30	1.50	1.00	0.62	2.70	1.60	0.62
1 1/4	1.84	8.00	9.00	2.30	6.90	1.70	1.40	0.83	3.60	2.30	0.83
1 1/2	2.15	9.50	11.00	2.70	8.10	2.00	1.60	0.97	4.50	2.70	0.97
2	2.76	13.00	14.00	3.50	10.30	2.50	2.00	1.30	5.40	3.50	1.30
2 1/2	3.29	15.00	16.00	4.10	12.30	3.00	2.50	1.50	6.50	4.00	1.50
3	4.09	18.00	19.00	5.10	15.30	4.00	2.90	1.80	8.00	4.80	1.80
3 1/2	4.50	20.00	22.00	6.30	20.00	4.50	3.40	2.10	10.00	5.60	2.10
4	5.00	23.00	25.00	7.20	23.00	5.00	4.00	2.40	12.00	6.40	2.40

NOTE: 1/8" to 4" are standard pipe sizes.

TECHNICAL DATA

HYDRONIC WATER FLOW CALCULATOR

(GALLONS PER MINUTE FOR BTU/HR AT VARIOUS WATER TEMPERATURE DROPS)

BTU/HR	WATER TEMPERATURE DROP					BTU/HR	WATER TEMPERATURE DROP				
	10°F	20°F	30°F	40°F	50°F		10°F	20°F	30°F	40°F	50°F
	GPM						GPM				
101,000	20.2	10.1	6.7	5.1	4.0	151,000	30.2	15.1	10.1	7.6	6.0
102,000	20.4	10.2	6.8	5.1	4.1	152,000	30.4	15.2	10.1	7.6	6.1
103,000	20.6	10.3	6.9	5.2	4.1	153,000	30.6	15.3	10.2	7.7	6.1
104,000	20.8	10.4	6.9	5.2	4.2	154,000	30.8	15.4	10.3	7.7	6.2
105,000	21.0	10.5	7.0	5.3	4.2	155,000	31.0	15.5	10.3	7.8	6.2
106,000	21.2	10.6	7.1	5.3	4.2	156,000	31.2	15.6	10.4	7.8	6.2
107,000	21.4	10.7	7.1	5.4	4.3	157,000	31.4	15.7	10.5	7.9	6.3
108,000	21.6	10.8	7.2	5.4	4.3	158,000	31.6	15.8	10.5	7.9	6.3
109,000	21.8	10.9	7.3	5.5	4.4	159,000	31.8	15.9	10.6	8.0	6.4
110,000	22.0	11.0	7.3	5.5	4.4	160,000	32.0	16.0	10.7	8.0	6.4
111,000	22.2	11.1	7.4	5.6	4.4	161,000	32.2	16.1	10.7	8.1	6.4
112,000	22.4	11.2	7.5	5.6	4.5	162,000	32.4	16.2	10.8	8.1	6.5
113,000	22.6	11.3	7.5	5.7	4.5	163,000	32.6	16.3	10.9	8.2	6.5
114,000	22.8	11.4	7.6	5.7	4.6	164,000	32.8	16.4	10.9	8.2	6.6
115,000	23.0	11.5	7.7	5.8	4.6	165,000	33.0	16.5	11.0	8.3	6.6
116,000	23.2	11.6	7.7	5.8	4.6	166,000	33.2	16.6	11.1	8.3	6.6
117,000	23.4	11.7	7.8	5.9	4.7	167,000	33.4	16.7	11.1	8.4	6.7
118,000	23.6	11.8	7.9	5.9	4.7	168,000	33.6	16.8	11.2	8.4	6.7
119,000	23.8	11.9	7.9	6.0	4.8	169,000	33.8	16.9	11.3	8.5	6.8
120,000	24.0	12.0	8.0	6.0	4.8	170,000	34.0	17.0	11.3	8.5	6.8
121,000	24.2	12.1	8.1	6.1	4.8	171,000	34.2	17.1	11.4	8.6	6.8
122,000	24.4	12.2	8.1	6.1	4.9	172,000	34.4	17.2	11.5	8.6	6.9
123,000	24.6	12.3	8.2	6.2	4.9	173,000	34.6	17.3	11.5	8.7	6.9
124,000	24.8	12.4	8.3	6.2	5.0	174,000	34.8	17.4	11.6	8.7	7.0
125,000	25.0	12.5	8.3	6.3	5.0	175,000	35.0	17.5	11.7	8.8	7.0
126,000	25.2	12.6	8.4	6.3	5.0	176,000	35.2	17.6	11.7	8.8	7.0
127,000	25.4	12.7	8.5	6.4	5.1	177,000	35.4	17.7	11.8	8.9	7.1
128,000	25.6	12.8	8.5	6.4	5.1	178,000	35.6	17.8	11.9	8.9	7.1
129,000	25.8	12.9	8.6	6.5	5.2	179,000	35.8	17.9	11.9	9.0	7.2
130,000	26.0	13.0	8.7	6.5	5.2	180,000	36.0	18.0	12.0	9.0	7.2
131,000	26.2	13.1	8.7	6.6	5.2	181,000	36.2	18.1	12.1	9.1	7.2
132,000	26.4	13.2	8.8	6.6	5.3	182,000	36.4	18.2	12.1	9.1	7.3
133,000	26.6	13.3	8.9	6.7	5.3	183,000	36.6	18.3	12.2	9.2	7.3
134,000	26.8	13.4	8.9	6.7	5.4	184,000	36.8	18.4	12.3	9.2	7.4
135,000	27.0	13.5	9.0	6.8	5.4	185,000	37.0	18.5	12.3	9.3	7.4
136,000	27.2	13.6	9.1	6.8	5.4	186,000	37.2	18.6	12.4	9.3	7.4
137,000	27.4	13.7	9.1	6.9	5.5	187,000	37.4	18.7	12.5	9.4	7.5
138,000	27.6	13.8	9.2	6.9	5.5	188,000	37.6	18.8	12.5	9.4	7.5
139,000	27.8	13.9	9.3	7.0	5.6	189,000	37.8	18.9	12.6	9.5	7.6
140,000	28.0	14.0	9.3	7.0	5.6	190,000	38.0	19.0	12.7	9.5	7.6
141,000	28.2	14.1	9.4	7.1	5.6	191,000	38.2	19.1	12.7	9.6	7.6
142,000	28.4	14.2	9.5	7.1	5.7	192,000	38.4	19.2	12.8	9.6	7.7
143,000	28.6	14.3	9.5	7.2	5.7	193,000	38.6	19.3	12.9	9.7	7.7
144,000	28.8	14.4	9.6	7.2	5.8	194,000	38.8	19.4	12.9	9.7	7.8
145,000	29.0	14.5	9.7	7.3	5.8	195,000	39.0	19.5	13.0	9.8	7.8
146,000	29.2	14.6	9.7	7.3	5.8	196,000	39.2	19.6	13.1	9.8	7.8
147,000	29.4	14.7	9.8	7.4	5.9	197,000	39.4	19.7	13.1	9.9	7.9
148,000	29.6	14.8	9.9	7.4	5.9	198,000	39.6	19.8	13.2	9.9	7.9
149,000	29.8	14.9	9.9	7.5	6.0	199,000	39.8	19.9	13.3	10.0	8.0
150,000	30.0	15.0	10.0	7.5	6.0	200,000	40.0	20.0	13.3	10.0	8.0

NOTES: *S.P.S. copper and brass pipe.

No allowance has been made for age, difference in diameter, or any abnormal condition of the interior surface. Any factor of safety must be estimated from the local conditions and the requirements of each particular installation. It is recommended that for most commercial design purposes a safety factor of 15 to 20% be added to the values in the tables.

TECHNICAL DATA

CONVERSIONS FACTORS






















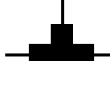

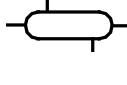



<p>1 U.S. Gallon = 231 Cubic Inches = 0.1337 Cubic Feet = 3.785 Liters = 0.833 Imp. Gallons</p> <hr/> <p>2 Imperial Gallon = 1.2 U.S. Gallons</p>	<p>1 Cubic Foot = 7.48 U.S. Gallons = 0.0283 Cubic Meters</p> <hr/> <p>1 Liter = 0.264 U.S. Gallons</p> <hr/> <p>1 Cubic Meter = 35.314 Cubic Feet = 264.2 U.S. Gallons = 999.97 Liters</p>
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CONVERSIONS

TO CONVERT THIS	TO THIS	MULTIPLY BY
Q(m³/hr) Cubic meters per hour	GPM Gallons per minute	$Q(m^3/hr) \times 4.4 =$
Q(L/s) Liters per second	GPM Gallons per minute	$L/s \times 15.85 =$
Q(L/min) Liters per minute	GPM Gallons per minute	$L/m \times 0.264 =$
P(kW) Kilowatts	HP Horsepower	$kW \times 1.34 =$ $kW / 0.746 =$
BAR Of pressure	PSI Absolute (PSIA) Pounds per square inch of pressure (includes atmospheric pressure at sea level)	$BAR \times 14.5 + 14.7 =$
BAR Of pressure	PSI Gauged (PSIG) Pounds per square inch of pressure as it would be read on a pressure gauge (does not include atmospheric pressure)	$BAR \times 14.5 =$
PSIG Gauge pressure	Head, Feet	$PSI \times 2.31 / SP.GR. =$
Millimeters	Inches	$(mm) \times 0.0394 =$
Meter	Feet	$(meters) \times 3.28 =$
Centimeters	Inches	$centimeters \times 2.54 =$
Nm (Newton meter) Measure of torque	Ft. lbs. Foot pound of torque	$Nm \times 0.7376 =$
°C Degrees Celsius	°F Degrees Fahrenheit	$^{\circ}C (9/5) + 32 =$
Watts	Horsepower	$Watts \times 0.001341 =$
Watts	Btu/hr British thermal units per hour	$Watts \times 3.4127 =$
Boiler Horsepower	Btu/hr	$Boiler Hp \times 33479 =$

TECHNICAL DATA

TYPICAL SYMBOLS

	Globe valve		Circulator pump
	Gate valve		Float-type vent
	Ball valve		Spirovent air separator
	Thermostatic radiator valve (TRV)		Union
	Drain / fill valve		Expansion tank
	Electronic zone valve		Blower
	Angle TRV valve		Finned-tube baseboard
	Pressure reducing valve		Heat exchanger coil
	3-way mixing valve		Thermometer
	4-way mixing valve		Pressure gauge
	Swing check valve		Diverter tee
	Backflow preventer		Heat exchanger
	Pressure relief valve		
	Flo-check valve		
	Metered balancing valve		

PRODUCT SOLUTION OUTLINES/BROCHURES

BROCHURES

FILE NUMBERS	TITLE	DESCRIPTION
10.10	Series S&H	In-Line Circulators
10.11	Series 1050 & 1060	Custom In-Line Circulators
10.115	Genuine Replacement Parts	Gold Series - Pump Less Volute Kit
10.12	Astro Series	Wet Rotor Circulators
10.121	Astro Series	Hot Water Re-circulation Systems
10.123	Astro Series	Three Speed Wet Rotor Circulators
10.125	Astro 2 Series	3- Speed Wet-Rotor Circulators
10.14	S B A	Seal Bearing Assemblies for S & H Series Circulators
10.16	Series E	ARM flo Circulators
10.161	Spool Pieces	ARMflo E Series Spool Pieces
10.19	Compass	Design Envelope Variable Speed Wet Rotor Circulator
10.315	Astro Express	Hot Water Re-circulation System
11.10	Hydronic Catalog	Relief & Reducing Valves
11.14	Series AV	Automatic Air Vents
11.15	Series CIF	Circulator Isolation Flanges
11.16	Flex Flange Kits	Flex Flange Kits
36.11	CBV	Circuit Balancing Valves
36.15	Series DPM	Differential Pressure Manometer
36.16	Series KNX	Configured Hydronic Hook-Up Kits
37.10	Series AX and L	Expansion Tanks
37.15	Vortex Air Separators	Vortex Air Separators
42.10	Series 4270	Motor Mounted Centrifugal Pumps

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Page 23

Product Series 1050

Change required to Mounting orientation text.

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