Design Envelope Booster Systems

ARMSTRONG

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The Design Envelope is your Safety Net

Design Envelope Booster Systems provide a reliable supply of domestic water in a compact, energy-efficient and easy to install package that addresses the problem of insufficient water pressure during peak load times.

Armstrong Design Envelopes are a pre-set series of the most efficient pump selections for a given capacity range. The Design Envelope approach allows you to reduce your design risk and avoid costs from equipment change orders. By calculating your preliminary design conditions and then selecting a Design Envelope with sufficient comfort zone around the preliminary design point, you can select a unit that allows for possible design omissions or system changes anticipated during construction and over the life of the building.

There is no longer a need to oversize your initial design point. The Design Envelope functions as a safety net for the anticipated system changes due to as-built design, building envelope adjustments or tenant demographic changes.

Specifying an oversized booster package typically results in lower efficiency under actual operating conditions. System designers can now select the appropriate booster Design Envelope and be assured that the package will provide high efficiency throughout the entire Design Envelope and operating range of the unit.

There is no longer a need to browse extensive catalog information or make difficult selection software decisions. Using the Armstrong Design Envelope approach you can select and specify the Design Envelope booster that suits your current and anticipated needs while taking advantage of Armstrong's superior control technology.

▸Capital and Installation Costs are Reduced

- ▸Reduced capital cost – integrated design uses fewer components and lighter weight reduces freight costs
- ▸Reduced installation cost – compact design reduces the size of the housekeeping pad, resulting in a reduction of site labor and material costs
- ▸Reduced commissioning cost – units are factory pre-set and tested to design conditions and provide easy access to adjustable set-points
- ▸Reduced plant room space cost – Vertical MultiStage Pumps require 50% less floor space than horizontal single stage pumps

▸Increased Energy Savings

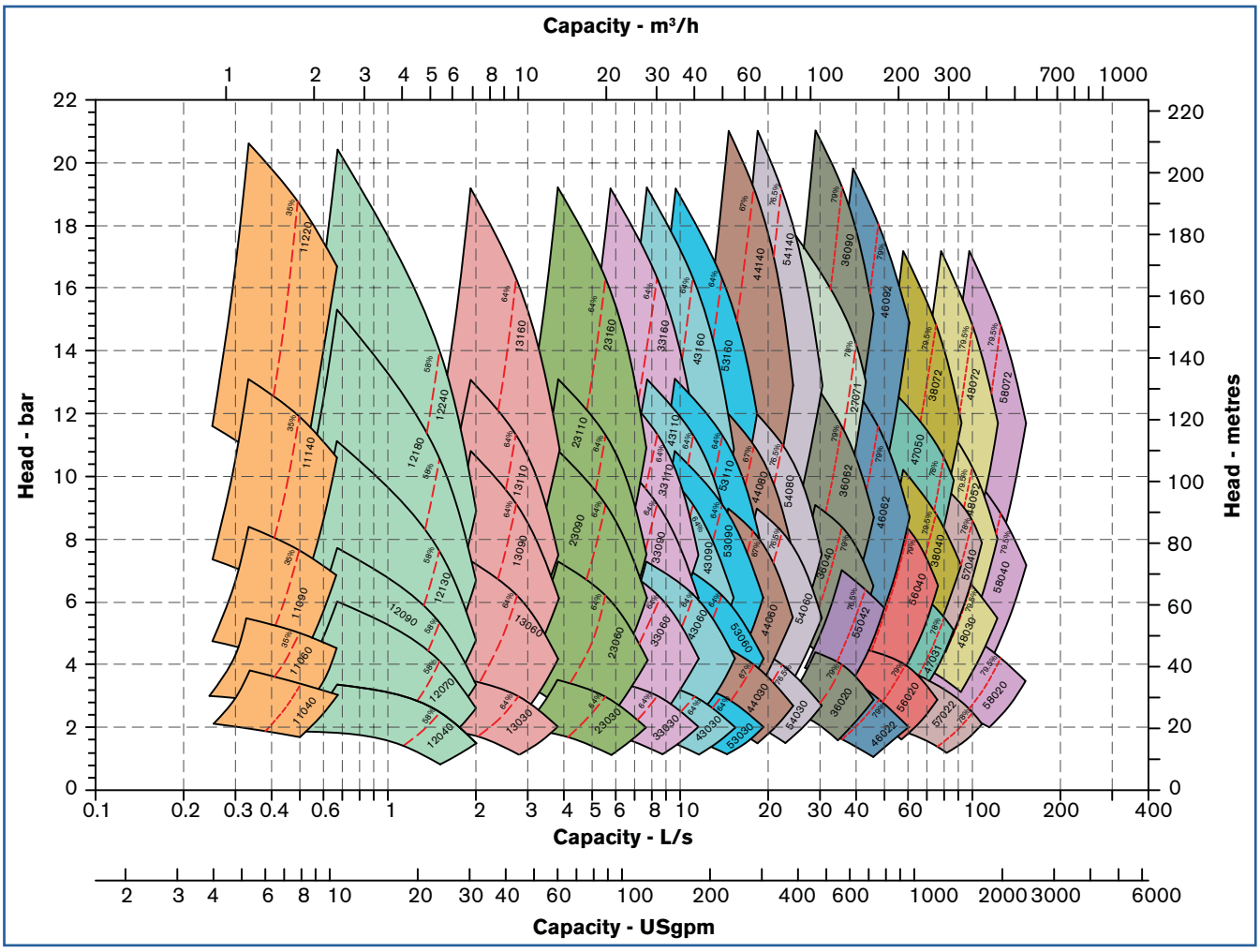
- ▸Optimises pumping with a reduced installation cost
- ▸Energy is not wasted working against a pressure regulating valve
- ▸No-Flow Shutdown mode and optional tank allow the pumps to be turned off during periods of no demand

▸Project Risk Minimisation

- ▸Soft-Fill mode reduces pump vibration and water hammer during startup and after a power outage
- ▸Integrated controls reduce the risk of RFI/EMC (radio frequency interference/electromagnetic compatibility) problems
- ▸Single source responsibility for the complete packaged system
- ▸Units are factory calibrated and tested to over the range of the Design Envelope, reducing on-site commissioning and start-up delays

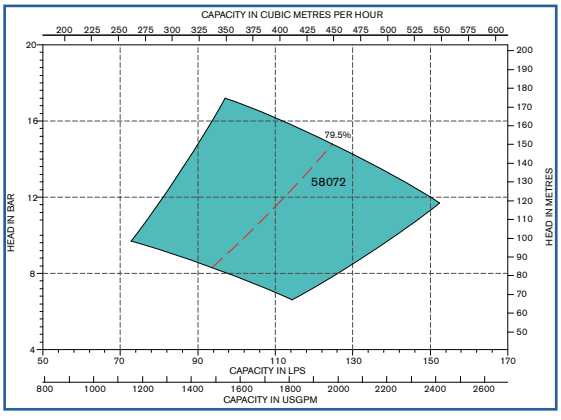
Integrated design provides all these functions in one compact booster package for system requirement up to 152 L/s (1975 USgpm). The Design Envelope Booster Packages are assembled and delivered as a complete pumping package, ready to install, wire and start for immediate operation.

Design Envelope Booster



▶Design Envelope Selection Procedure

- ▶Mark your preliminary design flow and head requirements on the Design Envelope (DE) chart
- ▶Choose the DE that best represents your design parameters, plus a comfortable safety margin in the flow and head to cover any anticipated increases or reductions in design demand from design errors or building modifications during construction
- ▶Be assured that each DE selection retains the highest efficiency possible throughout the DE range
- ▶Specify the DE model number from the chart, noting the flow, head and efficiency values at the Best Efficiency Point (BEP) value for your specification
- ▶The DE Technical Data Chart (inside spread of this brochure) details the size, power requirements, dimensions and weight of each unit



Armstrong's ACE Online will also help you select the most appropriate DE unit using a similar process.

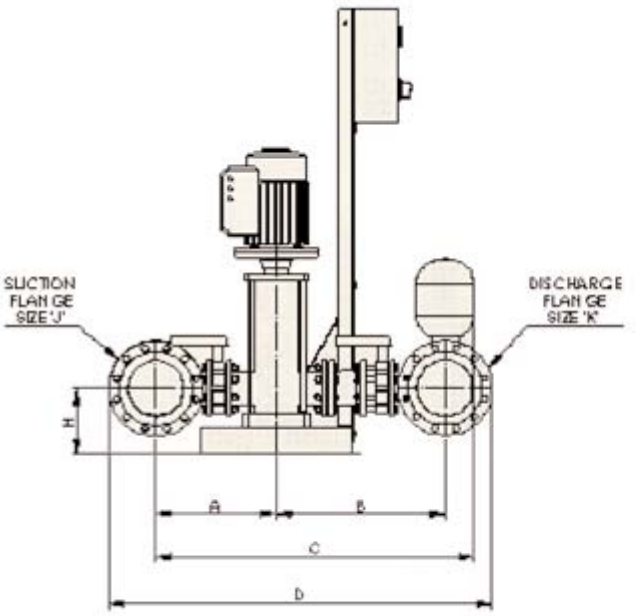
▶ Design Envelope Booster Data

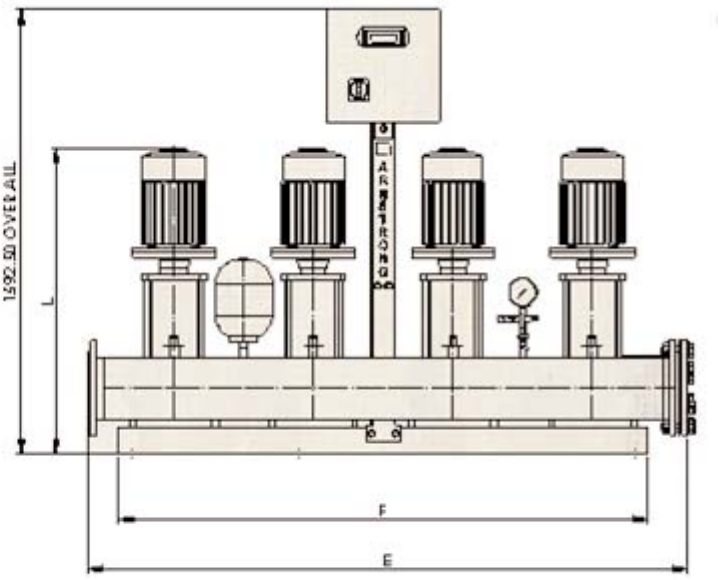
Envelope Curve Number ▲	Total kW	No. of Pumps	Dimensions (mm)									Maximum Working Pressure (bar)	Set Weight (kg)
			A	B	C	D	E	F	H	J/K*	L		
11040	0.55	2	186	216	505	- - -	- - -	560	140	1½" BSP **	621	4.2	86
11060	0.75	2	186	216	505	- - -	- - -	560	140	1½" BSP **	686	6.3	92
11090	1.1	2	186	216	505	- - -	- - -	560	140	1½" BSP **	798	9.4	96
11140	2.2	2	186	216	505	- - -	- - -	560	140	1½" BSP **	933	14.6	115
11220	3	2	237	308	648	- - -	- - -	560	140	1½" BSP **	1183	22.6	134
12040	0.75	2	219	251	573	- - -	- - -	560	140	2" BSP **	636	3.9	90
12070	1.1	2	219	251	573	- - -	- - -	560	140	2" BSP **	748	6.9	94
12090	1.5	2	219	251	573	- - -	- - -	560	140	2" BSP **	808	8.0	108
12130	2.2	2	219	251	573	- - -	- - -	560	140	2" BSP **	908	12.8	114
12180	3	2	268	348	719	- - -	- - -	560	140	2" BSP **	1083	17.8	130
12240	4	2	268	348	719	- - -	- - -	560	140	2" BSP **	1237	23.7	169
13030	1.5	2	258	300	661	- - -	- - -	700	145	2" BSP **	739	4	122
13060	3	2	258	300	661	- - -	- - -	700	145	2" BSP **	903	8	142
13090	4	2	258	300	661	- - -	- - -	700	145	2" BSP **	1021	12.1	177
13110	5.5	2	258	300	661	- - -	- - -	700	145	2" BSP **	1184	14.8	206
13160	7.5	2	293	396	792	- - -	- - -	700	145	2" BSP **	1374	21.5	223
23030	3	2	258	300	661	- - -	- - -	700	145	2" BSP **	739	4	122
23060	6	2	258	300	661	- - -	- - -	700	145	2" BSP **	903	8	142
23090	8	2	258	300	661	- - -	- - -	700	145	2" BSP **	1021	12.1	177
23110	11	2	258	300	661	- - -	- - -	700	145	2" BSP **	1184	14.8	206
23160	15	2	293	396	792	- - -	- - -	700	145	2" BSP **	1374	21.5	223
27071	74	2	423	646	1172	1354	1151	1150	205	150 NB †	1827	20.3	744
33030	4.5	3	264	306	673	- - -	- - -	1250	145	2½" BSP **	739	4	168
33060	9	3	264	306	673	- - -	- - -	1250	145	2½" BSP **	903	8	188
33090	12	3	264	306	673	- - -	- - -	1250	145	2½" BSP **	1021	12.1	223
33110	16.5	3	264	306	673	- - -	- - -	1250	145	2½" BSP **	1184	14.8	252
33160	22.5	3	299	402	804	- - -	- - -	1250	145	2½" BSP **	1374	21.5	269
36020	22.5	3	407	580	1089	1271	1651	1400	205	150 NB †	1063	5.1	562
36040	45	3	407	580	1089	1271	1651	1400	205	150 NB †	1362	10.6	698
36062	66	3	407	580	1089	1271	1651	1400	205	150 NB †	1556	14.1	760
36090	111	3	407	580	1089	1271	1651	1400	205	150 NB †	1862	23.6	842
38040	90	3	449	672	1223	1460	1653	1400	205	200 NB †	1557	13	939
38072	135	3	449	672	1223	1460	1653	1400	205	200 NB †	1924	21.3	1155
43030	6	4	272	314	689	- - -	- - -	1650	145	3" BSP **	739	4	209
43060	12	4	272	314	689	- - -	- - -	1650	145	3" BSP **	903	8	229
43090	16	4	272	314	689	- - -	- - -	1650	145	3" BSP **	1021	12.1	264
43110	22	4	272	314	689	- - -	- - -	1650	145	3" BSP **	1184	14.8	293
43160	30	4	307	410	820	- - -	- - -	1650	145	3" BSP **	1374	21.5	310
44030	12	4	334	395	832	- - -	- - -	1550	155	4" BSP **	799	5.1	255
44060	22	4	334	395	832	- - -	- - -	1550	155	4" BSP **	1004	10.2	317
44080	30	4	334	395	832	- - -	- - -	1550	155	4" BSP **	1080	13.5	329
44140	60	4	336	394	833	- - -	- - -	1550	155	4" BSP **	1454	23.7	439
46022	22	4	432	605	1140	1377	2153	1900	235	200 NB †	1063	3.8	783
46062	88	4	432	624	1159	1386	2153	1900	235	200 NB †	4556	14.1	993
46092	120	4	432	624	1159	1386	2153	1900	235	200 NB †	1862	22.1	1055
47031	60	4	449	672	1223	1460	2153	1900	238	200 NB †	1342	8.3	990

Design Envelope Booster

Envelope Curve Number ▲	Total kW	No. of Pumps	Dimensions (mm)									Maximum Working Pressure (bar)	Set Weight (kg)
			A	B	C	D	E	F	H	J/K*	L		
47050	120	4	449	672	1223	1460	2153	1900	238	200 NB †	1647	14.9	1096
48030	88	4	476	699	1277	1579	2162	1900	238	250 NB †	1386	10.1	1223
48052	148	4	476	699	1277	1579	2162	1900	238	250 NB †	1647	14.5	1307
48078	180	4	476	699	1277	1579	2162	1900	238	250 NB †	1924	21.3	1487
53030	7.5	5	283	327	713	- - -	- - -	1930	145	4" BSP **	739	4	270
53060	15	5	283	327	713	- - -	- - -	1930	145	4" BSP **	903	8	290
53090	20	5	283	327	713	- - -	- - -	1930	145	4" BSP **	1021	12.1	325
53110	27.5	5	283	327	713	- - -	- - -	1930	145	4" BSP **	1184	14.8	354
53160	37.5	5	318	423	844	- - -	- - -	1930	145	4" BSP **	1374	21.5	371
54030	15	5	316	422	886	1068	2151	1930	155	150 NB †	799	5.1	449
54060	27.5	5	316	422	886	1068	2151	1930	155	150 NB †	1004	10.2	511
54080	37.5	5	316	422	886	1068	2151	1930	155	150 NB †	1080	13.5	523
54140	75	5	363	421	887	1069	2151	1930	155	150 NB †	1454	23.7	633
55042	37.5	5	405	549	1056	1293	2653	2400	170	200 NB †	1173	8	896
56020	37.5	5	432	605	1140	1377	2653	2400	268	200 NB †	1063	5.1	946
56040	75	5	432	605	1140	1377	2653	2400	268	200 NB †	1362	10.6	1082
57022	55	5	476	699	1277	1579	2662	2400	268	250 NB †	1191	5.9	1237
57040	110	5	476	699	1277	1579	2662	2400	268	250 NB †	1476	12	1367
58020	75	5	501	724	1328	1685	2662	2400	268	300 NB †	1252	6.6	1496
58040	150	5	501	724	1328	1685	2662	2400	268	300 NB †	1557	13	1604
58072	225	5	501	724	1328	1685	2662	2400	268	300 NB †	1924	21.3	1820

* Suction Flange Size J / Discharge Flange Size K, Available in PN16 and PN25
** Screwed Connection
† Flange
▲Curves beginning with a 1 are Duty/standby arrangement





▶ Typical Specifications

PART I: GENERAL

Quality Assurance: Single-Source Responsibility for complete package.

Design Criteria: The drawings indicate sizes, profiles, connections and dimensional requirements of plumbing pumps and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other manufacturers may be considered, provided that deviations in dimensions and profiles do not change the design intent and performance as judged by the engineer. The burden of proof for equality is on the proposer.

Delivery and Storage: Store pumps in a dry location. Retain shipping flange protective covers and protective coatings during storage. Protect bearings and couplings against damage from sand, grit and other foreign matter. Comply with manufacturers' rigging instructions for handling.

PART II: PRODUCTS

Domestic Water Booster System: Provide an Armstrong Design Envelope Booster System model _____. The Design Envelope shall encompass an initial design point of _____ L/s (m^3/h) at _____ bar (m) head. The Design Envelope shall also be capable of supplying _____L/s (m^3/h) at _____ bar (m) head at ____% efficiency level.

Pumps: Each Vertical MultiStage (VMS) pump, with pump characteristics which provide rising heads to shut off, shall be supplied with a ____kW, TEFV, 50/3/400V, high efficiency motor and an Armstrong IP55 enclosure variable speed drive, which shall be integrated with the motor. Drives shall not be enclosed within the control panel.

Integrated Variable Frequency Drive (VFD): VFD shall be of the VVC-PWM type providing near unity displacement power factor (cos) without the need for external power factor correction capacitors at all loads and speeds. VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. VFD shall be UL and C-UL Listed & CE Marked showing compliance with both the EMC Directive 89/336/EEC and the Low Voltage Directive 72/23/EEC. RFI filters shall be incorporated within the drive to ensure it meets the emission and immunity requirements of EN61800-3 to the 1st Environment Class C1 (EN55011 unrestricted sales class B).

Pump Construction:
Pump Casing - 304 stainless steel with PN16 flanges for working pressure to 16 bar (232 psig) at 120°C (250°F), 304 stainless steel with PN25 flanges for working pressure to 25 bar (370 psig) at 120°C (250°F), cast iron with PN16 flanges for working pressures to 16 bar (232 psig) at 120°C (250°F) and cast iron with PN25 flanges for working pressures to 25 bar (370 psig) at 120°C (250°F).
Impeller - Stainless steel, fully enclosed type.
Shaft - Stainless steel pump shaft.
Coupling - Rigid spacer type of aluminium or cast iron. Coupling to be designed to allow removal of all mechanical seal components for servicing without removal of the pump.
Mechanical Seals - Mechanical shaft seal with EPDM elastomer, carbon rotating face and silicon carbide stationary seat.

Pump Sequencing: The pump designated as the duty pump shall start after sensing a drop in the desired set point value. The pump controller shall compare a signal from the discharge pressure transducer to the set point value and the duty pump speed shall ramp up in order to satisfy the set point pressure. If the duty pump reaches maximum speed and demand continues to increase, a support pump will be staged on and the two pumps will run at an equal speed to maintain constant pressure. Should demand be reducing, pumps are staged out a pre-determined speed until only the duty pump is running. This pump will continue to regulate the pressure until such time where there is no demand and the set will enter 'sleep mode' where no pumps are running. On resumption of demand the designated duty pump will initiate and the staging sequence resumes. These steps shall be repeated in order to satisfy the building requirements for 2, 3, 4 and 5 pump packages. The duty pump shall alternate following a 'sleep' situation, following any fault or on a time adjusted basis which is factory set to 24 hrs.

Control Panel: The control panel shall be of the programmable logic controller (PLC) type. The complete control panel assembly and all internal devices shall be CE marked. The panel shall be complete with IP54 enclosure and include door interlocked main disconnect, water tight LCD interface, breaker VFD connections, adjustable time delays and Hand-Off-Auto selector for each pump. The control circuit shall include fault relay circuit to turn on the next pump should the lead pump fail.

The controller must be capable of controlling up to 5 pumps, using a 4-20 mA analogue signal using pressure as the control variable.

Controller design shall include provisions for system 'Soft-Fill' mode, low flow energy savings, best-operating-point (BOP) sequencing, automatic alternation of pumps, automatic omission of failed pumps, built-in pump on-delay timers, pump elapsed run time meters, smooth pump starting and sequencing, on-screen field modifiable control and alarm parameters, high system pressure shutdown and no-flow shutdown with drawdown tank/system optimization.

On-screen alarm display with alarm identification shall be incorporated with the following alarms included: low and high system pressure alarms, low water shutdown, pump failure, drive fault and discharge pressure transmitter failures. The controller shall include on-screen fault descriptions.

Non-volatile factory set parameters must be capable of being restored at any time in the field without requiring any programming device or connection to an external source. The controller must hold software in FLASH memory storage which prevents accidental loss of data due to voltage surge or spike.

All controls to be factory pre-wired and tested in accordance with provisions of the national electrical code. All control wires shall be individually numbered and each component shall be labeled accordingly.

Instrumentation and Controls: Pump system shall be supplied with manifold mounted liquid filled pressure gauges for indicating discharge pressure.

Factory Prefabrication: The system shall be factory prefabricated, including ball or butterfly isolation valves on the suction and discharge of each pump, spring loaded or silent check valves on the discharge as well as 2", 2.5", 3", 4", 6", 8",10" or 12" stainless steel headers with threaded or flanged adapter system connections. All interconnecting piping shall be stainless steel. The only field connections required shall be piping to the system headers and one incoming power connection at the control panel.

Factory Test and Certification: The booster system and its component parts shall undergo a complete operational test operating at the customers required setpoint. The system certification shall include copies of the test data as certified by a factory engineer. Performance test certifications should be placed inside the control panel.

Manufacturers: The above specification describes equipment manufactured by Armstrong Holden Brooke Pullen Ltd. Alternate manufacturers of equipment will be considered provided that they are completely equal as to type, capacity and efficiency of pumps and controls. Alternate manufacturers' submittals must be certified by an officer of the company who is proposing that their system complies with the specifications in every detail.

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