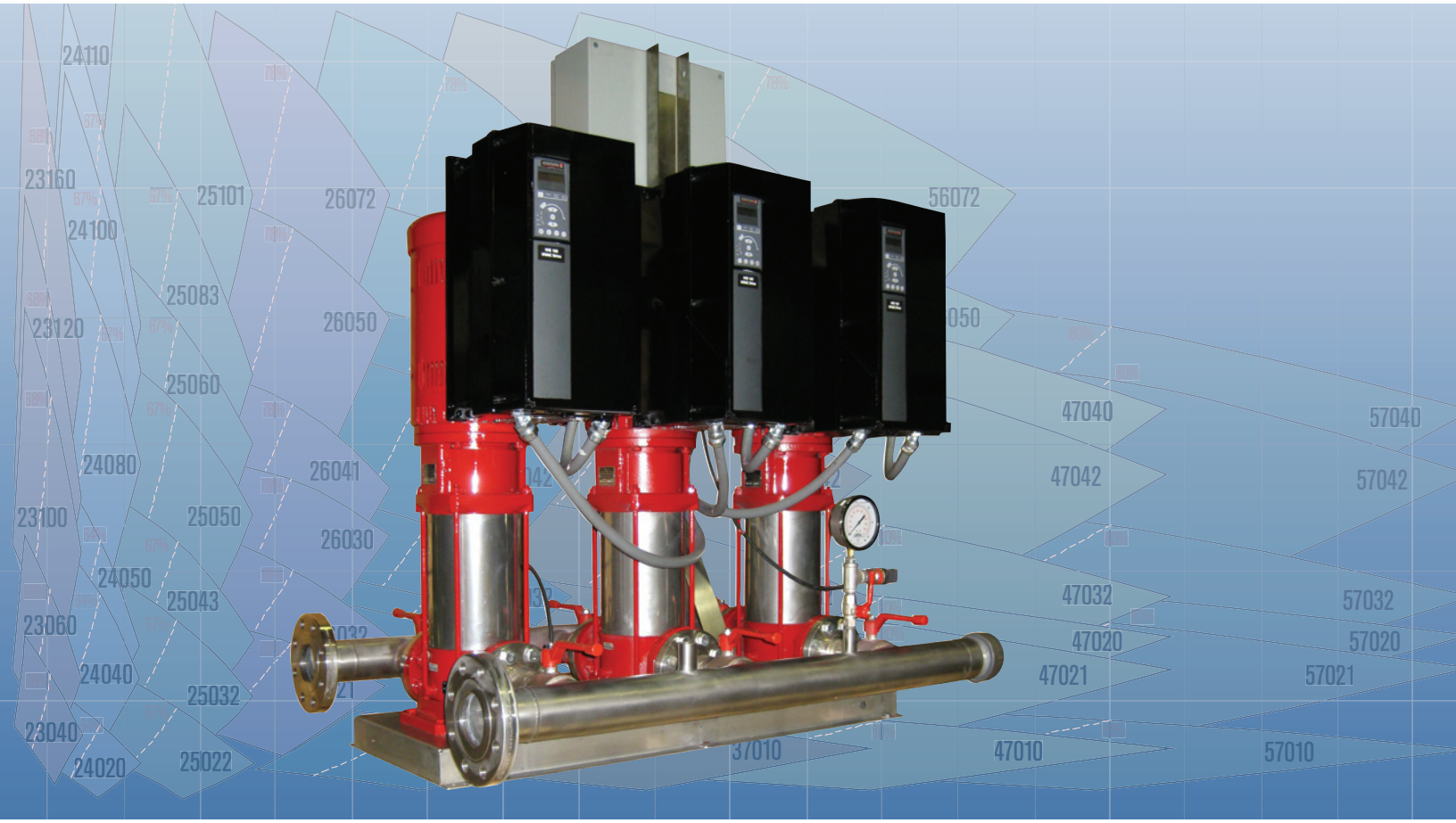
ARMSTRONG



# Design Envelope Booster Systems

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| DATE: | Jan. 15, 2010 |

# 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

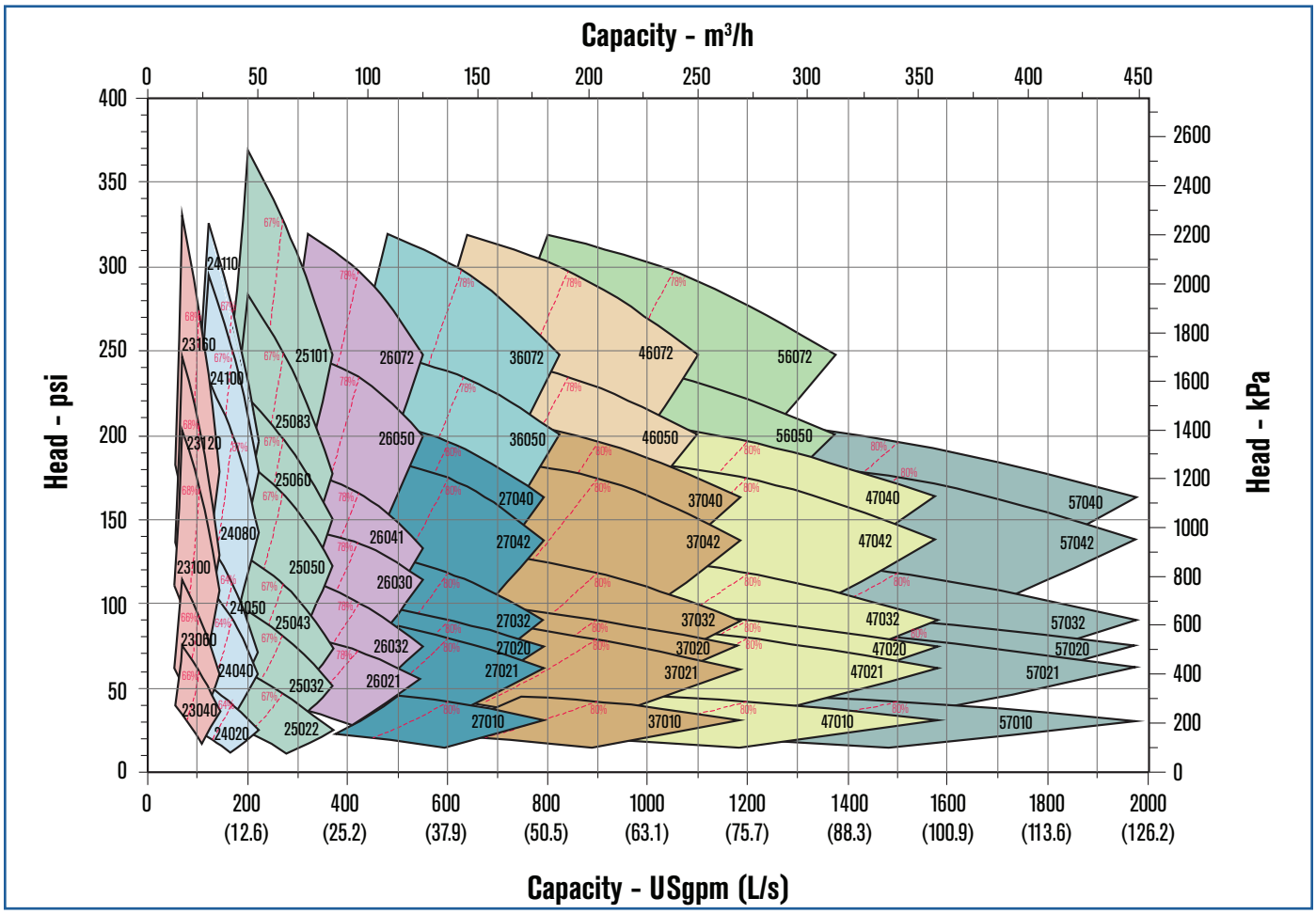
- Integrated controls optimize pumping efficiency
- Proprietary Pressure Setback mode reduces energy consumption by reducing system pressure setting at low flows
- Energy is not wasted working against a pressure regulating valve
- No-Flow Shutdown mode and optional tank allow the pumps to be turned off during periods of no demand

### ▸ Project Risk Minimization

- Soft-Fill mode reduces pump vibration and water hammer during startup and after a power outage
- No-Flow Shutdown feature eliminates the need for sensing lines and aquastat temperature relief
- Integrated controls reduce the risk of RFI/EMC (radio frequency interference/electromagnetic compatibility) problems
- Single source responsibility for the complete packaged system
- Ease of connectivity to Building Automation System (BAS)
- Packages are UL Listed and assembled in an ISO 9001 facility with UL and/or CSA approved components
- 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 requirements up to 1975 USgpm (152 L/s). The Design Envelope Booster Packages are assembled and delivered as a complete pumping package, ready to install, wire and start for immediate operation.

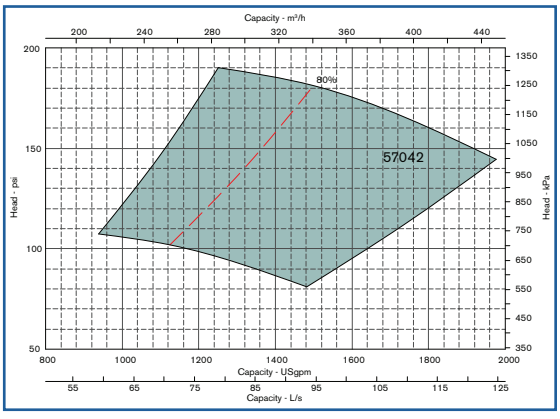
# Design Envelope Booster Systems




*Design Envelope Booster System Envelopes*

## 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




*Design Envelope Number 57042*

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

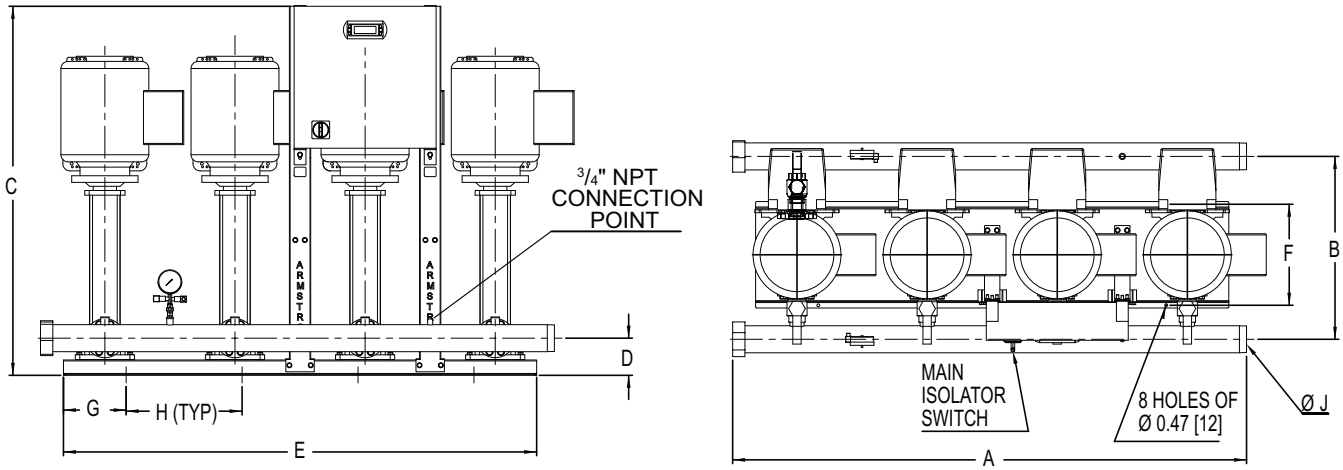
## ▶ Design Envelope Data – Booster Systems

| Envelope Curve Number | Total hp (kW) | No. of Pumps | Dimensions - inches (mm) | | | | | | | | | Working Pressure Maximum psi (bar) | Weight lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | J | | |
| 23040 | 6 (5) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 232 (16.0) | 693 (315) |
| 23060 | 10 (8) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 232 (16.0) | 768 (349) |
| 23100 | 15 (11) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 882 (401) |
| 23120 | 20 (15) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 1028 (467) |
| 23160 | 30 (22) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 1188 (540) |
| 24020 | 10 (8) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 232 (16.0) | 812 (369) |
| 24040 | 15 (11) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 232 (16.0) | 865 (393) |
| 24050 | 20 (15) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 232 (16.0) | 1015 (461) |
| 24080 | 30 (22) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 1184 (538) |
| 24100 | 40 (30) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 1545 (702) |
| 24110 | 50 (37) | 2 | 46.75 (1188) | 36.50 (927) | 61.42 (1560) | 6.18 (157) | 43.31 (1100) | 16.81 (427) | 1.97 (50) | 19.69 (500) | 3.00 (76) | 370 (26.0) | 1813 (824) |
| 25022 | 15 (11) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 200 (14.0) | 952 (433) |
| 25032 | 20 (15) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 200 (14.0) | 1097 (499) |
| 25043 | 30 (22) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 200 (14.0) | 1196 (543) |
| 25050 | 40 (30) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 370 (26.0) | 1491 (678) |
| 25060 | 50 (37) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 370 (26.0) | 1755 (797) |
| 25083 | 60 (445) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 370 (26.0) | 1907 (667) |
| 25101 | 80 (60) | 2 | 48.11 (1222) | 36.69 (932) | 61.42 (1560) | 6.78 (172) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 4.00 (102) | 400 (28.0) | 1959 (890) |
| 26021 | 30 (22) | 2 | 53.26 (1353) | 42.00 (1067) | 61.42 (1560) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 1517 (690) |
| 26030 | 50 (37) | 2 | 53.26 (1353) | 42.00 (1067) | 61.42 (1560) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 2063 (943 |
| 26032 | 40 (30) | 2 | 53.26 (1353) | 42.00 (1067) | 61.42 (1560) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 1803 (819) |

# Design Envelope Booster Systems

| Envelope Curve Number | Total hp (kW) | No. of Pumps | Dimensions - inches (mm) | | | | | | | | | Working Pressure Maximum psi (bar) | Weight lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | J | | |
| 26041 | 60 (44) | 2 | 53.26 (1353) | 42.00 (1067) | 61.42 (1560) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 370 (26.0) | 2205 (1002) |
| 26050 | 80 (60) | 2 | 53.26 (1353) | 42.00 (1067) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 370 (26.0) | 2271 (1032) |
| 26072 | 100 (74) | 2 | 53.26 (1353) | 42.00 (1067) | 61.42 (1560) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 370 (26.0) | 3406 (1548) |
| 27010 | 30 (22) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 1654 (752) |
| 27020 | 50 (37) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 2194 (997) |
| 27021 | 40 (30) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 1935 (880) |
| 27032 | 60 (44) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 200 (14.0) | 2306 (1048) |
| 27040 | 100 (74) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 370 (25.5) | 3450 (1568) |
| 27042 | 80 (60) | 2 | 53.26 (1353) | 44.23 (1123) | 73.42 (1865) | 8.15 (207) | 43.31 (1100) | 22.60 (574) | 1.97 (50) | 19.69 (500) | 6.00 (152) | 370 (25.5) | 2364 (1075) |
| 36050 | 120 (88) | 3 | 72.95 (1853) | 41.77 (1067) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 6.00 (152) | 370 (26.0) | 3213 (1461) |
| 36072 | 150 (111) | 3 | 72.95 (1853) | 41.77 (1067) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 6.00 (152) | 370 (26.0) | 4916 (2234) |
| 37010 | 45 (34) | 3 | 73.07 (1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 200 (14.0) | 2474 (1124) |
| 37020 | 75 (56) | 3 | 73.07 (1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 200 (14.0) | 3285 (1493) |
| 37021 | 60 (45) | 3 | 73.07 (1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 200 (14.0) | 2896 (1316) |
| 37032 | 90 (66) | 3 | 73.07 (1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 200 (14.0) | 3452 (1569) |
| 37040 | 150 (111) | 3 | 73.07 ((1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 370 (26.0) | 5168 (2349) |
| 37042 | 120 (90) | 3 | 73.07 ((1856) | 46.34 (1177) | 73.42 (1865) | 8.15 (207) | 62.99 (1600) | 22.60 (574) | 5.91 (150) | 25.59 (650) | 8.00 (203) | 370 (26.0) | 3539 (1607) |
| 46050 | 160 (120) | 4 | 96.69 (2456) | 44.00 (1118) | 74.70 (1897) | 9.43 (240) | 86.61 (2200) | 22.60 (574) | 7.87 (200) | 23.62 (600) | 8.00 (203) | 370 (26.0) | 4371 (1987) |
| 46072 | 200 (148) | 4 | 96.69 (2456) | 44.00 (1118) | 74.70 (1897) | 9.43 (240) | 86.61 (2200) | 22.60 (574) | 7.87 (200) | 23.62 (600) | 8.00 (203) | 370 (26.0) | 6641 (3018) |
| 47010 | 60 (45) | 4 | 96.69 (2456) | 46.23 (1174) | 74.70 (1897) | 9.43 (240) | 86.61 (2200) | 22.60 (574) | 7.87 (200) | 23.62 (600) | 8.00 (203) | 200 (14.0) | 3136 (1425) |
| 47020 | 100 (74) | 4 | 96.69 (2456) | 46.23 (1174) | 74.70 (1897) | 9.43 (240) | 86.61 (2200) | 22.60 (574) | 7.87 (200) | 23.62 (600) | 8.00 (203) | 200 (14.0) | 4218 (1917) |

| Envelope Curve Number | Total hp (kW) | No. of Pumps | Dimensions - inches (mm) | | | | | | | | | Working Pressure Maximum psi (bar) | Weight lbs (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G | H | J | | |
| 47021 | 80 | 4 | 96.69 | 46.23 | 74.70 | 9.43 | 86.61 | 22.60 | 7.87 | 23.62 | 8.00 | 200 | 3699 |
| | (60) | | (2456) | (1174) | (1897) | (240) | (2200) | (574) | (200) | (600) | (203) | (14.0) | (1681) |
| 47032 | 120 | 4 | 96.69 | 46.23 | 74.70 | 9.43 | 86.61 | 22.60 | 7.87 | 23.62 | 8.00 | 200 | 4441 |
| | (88) | | (2456) | (1174) | (1897) | (240) | (2200) | (574) | (200) | (600) | (203) | (14.0) | (2019) |
| 47040 | 200 | 4 | 96.69 | 46.23 | 74.70 | 9.43 | 86.61 | 22.60 | 7.87 | 23.62 | 8.00 | 200 | 6729 |
| | (148) | | (2456) | (1174) | (1897) | (240) | (2200) | (574) | (200) | (600) | (203) | (14.0) | (3059) |
| 47042 | 160 | 4 | 96.69 | 46.23 | 74.70 | 9.43 | 86.61 | 22.60 | 7.87 | 23.62 | 8.00 | 200 | 4556 |
| | (120) | | (2456) | (1174) | (1897) | (240) | (2200) | (574) | (200) | (600) | (203) | (14.0) | (2071) |
| 56050 | 200 | 5 | 120.31 | 44.00 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 8.00 | 370 | 5346 |
| | (150) | | (3056) | (1118) | (1927) | (270) | (2800) | (574) | (250) | (575) | (203) | (26.0) | (2430) |
| 56072 | 250 | 5 | 120.31 | 44.00 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 8.00 | 370 | 7203 |
| | (185) | | (3056) | (1118) | (1927) | (270) | (2800) | (574) | (250) | (575) | (203) | (26.0) | (3274) |
| 57010 | 250 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 200 | 4060 |
| | (185) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (14.0) | (1846) |
| 57020 | 125 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 200 | 5413 |
| | (92.5) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (14.0) | (2460) |
| 57021 | 100 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 200 | 4764 |
| | (74) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (14.0) | (2166) |
| 57032 | 150 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 200 | 5765 |
| | (110) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (14.0) | (2620) |
| 57040 | 250 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 370 | 8625 |
| | (185) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (26.0) | (3920) |
| 57042 | 200 | 5 | 120.38 | 48.47 | 75.88 | 10.61 | 110.24 | 22.60 | 9.84 | 22.64 | 10.00 | 370 | 5908 |
| | (150) | | (3057) | (1231) | (1927) | (270) | (2800) | (574) | (250) | (575) | (254) | (26.0) | (2685) |




*Typical 4-pump system shown.*

# Design Envelope Booster Systems

## Typical Specifications

### Domestic Water Booster System

Provide an Armstrong Series Design Envelope Packaged Booster System envelope number _____. The design envelope shall encompass an initial design point of _____ USgpm (L/s) at _____ psig (kPa) head. The design envelope shall also be capable of supplying _____USgpm (L/s) at _____ psig (kPa) head at ____% minimum efficiency level.

### Pumps

Each Vertical MultiStage (VMS) pump, with pump characteristics which provide rising heads to shut off, shall be supplied with a ____hp, ODP (TEFC), ____v/3/60, NEMA Premium® efficiency motor and an Armstrong UL Type-12 enclosure variable speed drive, which shall be integrated with the motor. Drives shall not be enclosed within the control panel.

The pump casings shall be 304 stainless steel with ANSI-250 flanges for working pressure to 370 psig (25 bar) at 250°F (120°C), cast iron with ANSI-150 flanges for working pressures to 232 psig (16 bar) at 250°F (120°C) or cast iron with ANSI-300 flanges for working pressures to 400 psig (27 bar) at 250°F (120°C) with rigid couplings, mechanical seals, stainless steel pump shafts and stainless steel, fully enclosed type impellers.

### Pump Sequencing

The pump designated as the lead pump shall start after a 5 second On-Delay time 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 lead pump speed shall ramp up in order to satisfy the set point pressure. The first lag pump shall start following a 5 second On-Delay time, when the lead pump exceeds its best operating point (BOP), and a minimum run timer shall ensure that the lag pump runs for a minimum of 5 minutes. The lag pump shall ramp down in speed and turn off when the 2 pumps that are running are operating at a point below the BOP and the lag pump minimum run timer has timed out. The lead pump shall continue to operate and meet system requirements based on the set point pressure. These steps shall be repeated in order to satisfy the building requirements for 2, 3, 4 and 5 pump packages. The lead pump shall alternate every 24 hrs of operation where the second pump shall be brought on for a period of 5 seconds, both pumps shall operate and the first pump on shall ramp down.

### Lead Pump Shutdown Controls

All systems are equipped with a "No-Flow" shutdown that will stop the pumps when the pump controller determines there has been a "No-Flow" condition for a continuous 5-minute period. The lead pump will start again once a drop in pressure of at least 5 psig (0.34 bar) is measured on the discharge of the system. Units supplied with a pressure tank shall be for intermittent operation, to prevent short cycling.* The system can be manually operated by means of the Hand-Off-Auto (HOA) selector buttons provided on the operator interface.

### 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 UL508 and/or CSA labeled. The panel shall be complete with NEMA Type ___ (3R, 4 or 12) enclosure and include door interlocked main disconnect, water tight LCD interface, fused drive connections, adjustable time delays, HOA selector for each pump and min run timers. 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 low flow energy savings, soft fill mode, pressure setback, best-operating-point (BOP) sequencing, end of pump curve protection, 24hr operation automatic alternation of pumps, built-in pump on-delay and minimum run timers, re-settable pump elapsed run time meters, smooth pump starting and sequencing, on-screen field modifiable control and alarm parameters, high suction 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 suction pressure shutdown, pump failure, drive fault, and suction and discharge pressure sensor failures. The controller shall include on-screen fault description and possible cause information with alarm horn for alarms. Optional BMS communication connection with _____ (Modbus, Lonworks, BACnet(MS/TP) or BACnet(IP/ENET)) protocol.

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. All internal wiring shall be Copper stranded, A.W.G. with a minimum 90°F (32°C) rating. The controller shall bear the UL508 label for industrial controls.

**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" - 10" (50 - 250 mm) stainless steel headers with threaded, grooved or optional flanged adapter system connections and stainless steel base and panel support. 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 flow test from zero to 100% design flow rate under the specified suction pressure conditions. The system certification shall include copies of the test data as certified by a factory engineer. In addition, the entire system shall be third party certified by Underwriters Laboratories Inc.

*Visit The Knowledge Exchange (www.armstrongpumps.com/knowledgeexchange), Systems and Controls Theory, Booster System Basics E-Learning module for more information on sizing and selecting drawdown pressure tanks.

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